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Peru, Homeland of the Warlike Inca

By Kit Ross

With Illustrations from Photographs by the Author

MOST of all on my last visit to Cusco I think I missed the sound of church bells. The earthquake had silenced them.

First reports of the disaster in Peru on May 21, 1950, received at National Geographic Society headquarters, indicated that the whole of this venerable city was in ruins.

Since I was then writing this article about Peru, I had to learn at once the extent of the damage. Accordingly, I packed my cameras and took off from Miami on the famed Pan American "Interamericano" plane for Lima. Two days later I was in Cusco to see things for myself.

First glimpse of the city from the air was deceiving. Superficially, it appeared the same pink-roofed jewel of the Andes as shown on page 442. At the airport I was greeted by Dr. Albert A. Giesecke, Civil Attaché of the U. S. Embassy staff in Lima, who had come to Cusco to coordinate relief and reconstruction work. From his jeep, on our way to the hotel, I saw the earthquake's shocking devastation (pages 422, 423).

Inca Walls Stood Firm

Towers of many of Cusco's famous Spanish colonial churches were fallen or shattered. Walls of the narrow old streets had caved in, blocking passage entirely in many instances. Some had been propped up with long poles to prevent collapse.

Every plaza, every available open space, was dotted with tents, temporary shelters, and medical dispensaries. Our driver constantly sounded his horn to clear homeless children and confused oldsters from our path (pages 427, 428).

Yet the ancient Inca walls stood firm! Earthquakes were not new to them.

Some 500 years before the Spanish conquest, the Incas, without knowledge of the wheel or of steel, raised these massive granite structures. How they shaped and dressed the stone, so hard that it will cut glass; how they notched the blocks to fit snugly together without mortar; and how they hoisted them, one on the other, sometimes to a height of 15 feet, are achievements which amaze all who see them (pages 424, 425, 426).

The conquering Spaniards destroyed the Inca temples and palaces, but they did not completely raze their walls. They used them as foundations upon which to erect their own buildings of stone and mortar masonry.

These newer structures tottered and collapsed in the quake. Adobe houses, many with walls three feet thick, were badly damaged. Some 90 percent of all the homes in Cusco were considered more or less unsafe for occupancy. Ninety people were killed.

But, unlike the walls of Jericho, those of the Incas refused to come tumbling down.

Chaos had followed in the wake of the disaster. Relief came quickly to the stricken community from the Peruvian Government and from the Peruvian, American, and International Red Cross. Building materials, medicines, clothing, and blankets were rushed in by plane in a confused jumble. Hourly the disorder grew worse. Then Dr. Giesecke arrived from Lima and, with the aid of other tireless workers, brought order.

This remarkable gentleman, known as "first citizen of Cusco," had lived in the community for many years, although he is a citizen of the United States. For 12 years he had



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Crumbled Tower and Buttressed Cloisters Proclaim the Ruinous Cusco Earthquake

To the Incas, gold was the "tears wept by the sun," their deity. They made his temple a veritable gold mine, its walls sheathed with gold, its gardens filled with golden flowers and trees. Rumors of this treasure led Francisco Pizarro to conquer and loot the city in 1533. Spaniards, trying to erase Inca memory, converted palaces into dwellings, temples into churches. Here Monastery of Santo Domingo rises above the Temple of the Sun. Struck by earthquake, May 21, 1950, its Spanish superstructure cracked, its Inca walls endured.

headed the University of Cusco; for three he served as the city's mayor.

The Cusqueños for the most part accepted the disaster philosophically, and I found them cheerfully tackling the job of cleaning up the wreckage. The Peruvians are among the most gracious of all Latin Americans. The Cusqueños particularly possess a charm all their own, as distinct as their Inca heritage and the unusual city which is their home. But the tragic aspects of the quake were always present.

As I was strolling in San Agustín Street, for example, I came to a corner where an adobe house had collapsed into a heap of rubble. Atop a section of an adjoining wall sat the owner, an elderly woman. Men were clearing away the debris. At intervals one of the workers would pause, hold up a tattered remnant of household equipment or a damaged trinket.

"Shall we save this?" he would ask.

"No, it's of no use now. Throw it away

with the rest," she would respond in a voice of resignation.

To return and see old friends and familiar surroundings under such circumstances was sad.

Restoration will require several years. However, if plans materialize, the city eventually will be even more interesting than before, since a distinguished group of scientists and archeologists is studying plans to make restoration as accurate as possible.

Recalls First Visit to Peru

My return to Cusco recalled some of my first contacts with the fascinating people of the Peruvian Andes.

With Rosita, my Spanish-American wife, I had taken an air tour around South America. We first touched Peruvian soil at Lima, but because we were eager to see the mountain country—most of all, Machu Picchu—we took off next morning for the short hop to Arequipa.



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Cusco's Upright Appearance Is Deceiving; the Earthquake Damaged 90 Percent of Its Homes

A general view taken a month after the quake shows the Plaza de Armas crowded with refugees' tents (page 447). Twin-towered La Compañía (center), erected by the Company of Jesus on the ruins of an Inca palace, suffered such injury that visitors were barred. La Merced (right), founded in 1536 and damaged by both the 1650 and 1950 quakes, sheathes its tower in scaffolding. "Viva el Perú" was boldly chalked on the mountainside by patriots of Battalion 19, Peruvian Army, who destroyed a Communist sign there.

From our flying classroom the geology and geography of the region unrolled below us.

The coastal area of Peru is a desert, one of the world's driest places. It stretches between South America's highest mountain range on one side and the Pacific Ocean on the other.

The earth beneath us skimmed past in wide stretches of Saharanlike sands, blown into frozen wave patterns or crescent-shaped dunes by the ceaseless march of the winds.

There were no oases such as those of the Sahara. Instead, this desert is veined by many Niles. In comparatively recent geological times the narrow land shelf was elevated to its present height, and rivers, draining from the mountains, cut deep trenches to the sea.

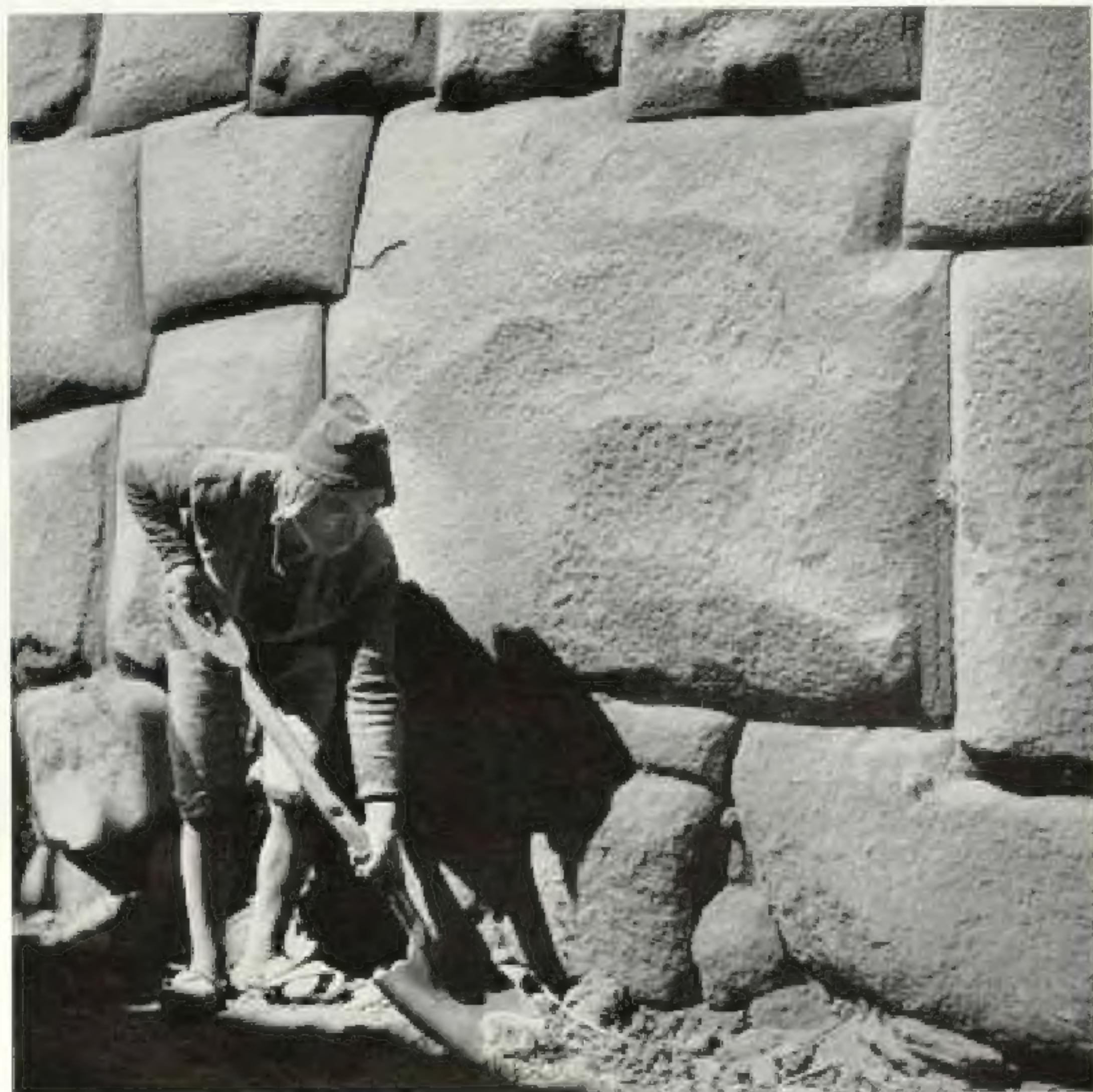
From one side of the plane we could look down into these valleys, each with a strip of brilliant green along the banks of its central river. Red-tiled roofs of tiny farmhouses gave a homey touch. From the other windows we looked east to the peaks of the sky-reaching Andes, silhouetted in the early-morning light.

From the air we looked down upon a giant relief map, for along the flat, dry surfaces of these uplifted areas we saw patterns of ancient river systems, complete with tributaries which tapered off into branches fine as ferns. They had not held water for years.

Suddenly something caught my eye. In contrast to the curving, irregular lines of rivers, the straight line I saw seemed strangely out of place. Then other lines came into view, some parallel, some intersecting, some fanning out like radio beacon marks. Mostly they ran east and west. Although they looked man-made, I saw no signs of habitation (page 448).

An Ancient Farmers' Almanac

Later, back in Lima, I met Miss María Reiche, astronomer and engineer, who explained the mysterious lines. That area was once the territory of the Nasca civilization, which preceded that of the Incas. Astronomers of this ancient world probably laid out



Cusco's Mortarless, 12-angled Stone Fits Its Neighbors Like a Jigsaw-puzzle Piece

Lacking steel tools and blasting powder, ancient quarrymen cut monoliths, some weighing hundreds of tons, and moved them without cranes or horses, across mountains. Then masons, working without cement, ground and fitted the blocks, some of irregular shape, so perfectly that, centuries and earthquakes later, razor blades cannot find a chink in many joints. Engineers can only guess at the ancients' secret methods.

these lines to aid their observations of the sun, moon, stars, and planets. Here indeed was an old farmers' almanac on a grand scale!

From the other side of the plane beautiful snow peaks beckoned. There was El Misti, 19,031 feet high, between his two less famous brothers, Chachani and Pichu-pichu, 19,077 and 18,054 feet, respectively. Then we started dropping down to land at Arequipa.

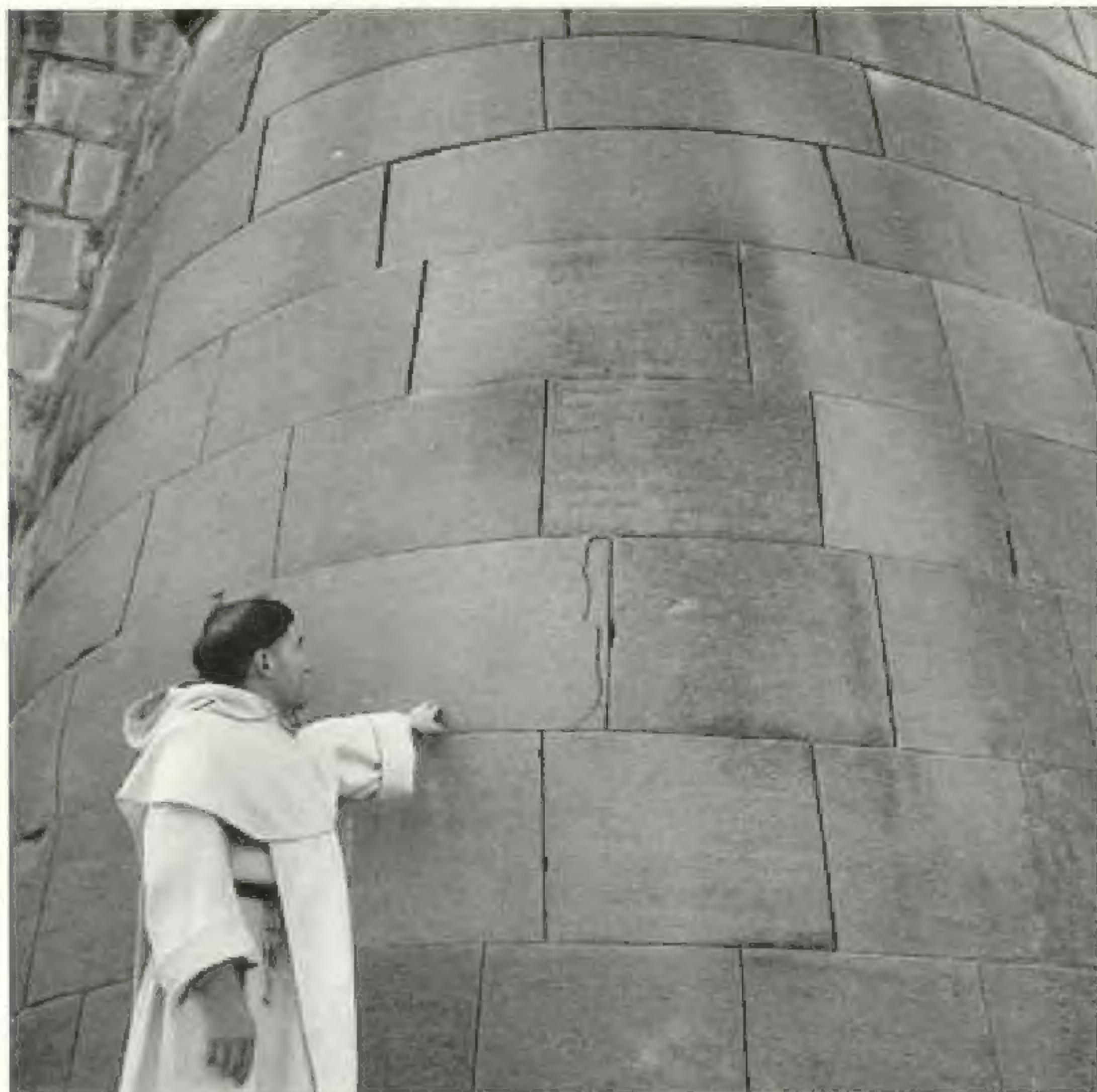
This lovely city lies in the lap of the Andes at an altitude of 7,500 feet, where average day-time temperature is 74° F., and average temperature after sundown is 58°. It has little rain and almost always clear, sunny skies. We found

this second city of Peru busy and modern.

Beneath electric light and telephone wires boys herd sheep or cattle along paved streets lined with walls of brilliant white and pink *sillar*, a volcanic substance which is a principal building material. Barefooted Indians trot over the cobblestones to market, and proud llamas mince daintily along the street-car tracks.

I had been told that llamas, alpacas, guanacos, and vicunas were timid. The alpaca I met was not.*

* See "Camels of the Clouds," by W. H. Hodges, NATIONAL GEOGRAPHIC MAGAZINE, May, 1946.



Solid Granite Splits (Center), but the Inca Joint an Inch Away Holds Fast

Ancient Peruvians, using rough, many-sided stones, constructed walls of amazing strength. Later, in the Inca period, they ground down smooth, rectangular blocks to build walls of exquisite grace. Indian architects planned this curving wall with a precise mathematical formula; yet they never attained the true arch. Father Calderón Salas's hand rests on the Temple of the Sun, foundation of his Church of Santo Domingo. Upper stones, yielding to earth shocks, have separated slightly (pages 422, 426).

In the new Hotel Turista we sat at a neat table beside a wide casement window. Beyond lush green grass and eucalyptus trees spread a matchless view of El Misti.

Through the open window a shaggy black head reached suddenly for the top roll on our plate. Just outside stood a full-grown alpaca! The waiter explained that this friendly fellow liked to vary his diet of grass with hot buttered rolls from guests' tables (page 462).

Four days of sight-seeing in this important city gave us time to get our breath before pushing farther into the Andes.

The train from Mollendo on the Pacific coast to Puno on Lake Titicaca ran only on Mondays, Wednesdays, and Fridays, and was already panting from its preliminary climb.

How short, I wondered, will our own breath be when we get to the high valley floor?

Two Days of Ups and Downs from Arequipa to Cusco

The salon car was early-American, equipped with leather-upholstered chairs. At one end of the car stood two men in uniform, one tall, the other slight, both neat in appearance. In



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Inca Walls, Built for Eternity, Defy Time and Quake; Spanish Frosting Topples

What must Cusco Indians think as they compare their ancestors' mortarless stones with the conquerors' cemented works? To picture Santo Domingo's former glory, see the NATIONAL GEOGRAPHIC MAGAZINE, August, 1947, page 168.



A Cloud of DDT Safeguards an Indian Against Vermin-borne Typhus

Following the earthquake, health authorities set up road blocks and stopped everyone entering Cusco. They vaccinated many against smallpox; they sprayed DDT above and beneath garments. Tickled by the hoses, most women screamed or giggled, but this one remained impassive.

other seats were a few Peruvian civilians.

The Southern Railway train took us steadily upward in a series of sweeping curves through rich green areas of alfalfa, wheat, and other irrigated fields bordered by varieties of cedar, cypress, and lovely eucalyptus. Soon most of the vegetation petered out, and our train twisted, swayed, and creaked through barren hills.

The taller of the two uniformed men introduced himself as Lt. Alvaro Lunati Revoredo, of the Guardia Civil of the Cusco Department. He was about six feet, broad-shouldered and husky, with friendly brown eyes.

The Civil Guard is a body of national police, all picked men especially trained for their work. They must have a knowledge of law, geography, history, mathematics, and native languages. Lunati was returning from headquarters at Lima, the capital, to his post at Urubamba, north of Cusco.

The other man was Capt. Victor Rosas Ramirez of the Peruvian Army, also bound for an isolated station in the interior.

Soon he and his friend were telling us of that little-known land among the mountain peaks which is the home of one of America's oldest civilizations.

"Archeologists have only scratched the surface of the highlands," said Lunati. "You will see Cusco, the capital of the Inca Empire of 500 years ago, but you must also see Machu Picchu, a lofty city in the sky whose origins still are mysterious."

Mystery People of the High Mountains

"What are the people like?" I asked.

"Indians of the high mountain country are unlike other Peruvians," replied Rosas. "They have the usual Mongoloid characteristics, but they are short and stocky, with a peculiar ruddy complexion. We of the lowlands find the mountain air extremely thin; they thrive on it."

"The Quechua they speak is a dialect of an ancient language which once was spoken throughout most of the Andes region."

Both men spoke Quechua, and soon we were learning new words in that language. *Runa* means "man," *huarmi*, "woman," *rucana*, "finger," *cocha*, "lake," *yana*, "black." The sound of some words was descriptive, such as *calleu*, "pigeon," and *huchua*, pronounced "wawa," meaning "baby."

At Pampa de Arrieros, a town at 12,303 feet above sea level, the train stopped for lunch.

Only those in the salon car had meals served on the train. From our window we saw other passengers pile out onto the platform where tables and chairs were set up in the open air.

The Top Higher than Pikes Peak

On station platforms I noted the increasing elevation—Pampa de Arrieros, 3,750 meters, Canaguns, 4,078 meters, Sumbay, 4,137 meters, Vincocaya, 4,377 meters. Every additional thousand meters meant approximately 3,000 feet of altitude.

"Here's a salute to the top!" said Lunati.

There, outside our window, bleak and gray in the clouds, stood the station of Crucero Alto, with the equivalent of 14,665 feet lettered in meters on the front. We were more than 500 feet higher than Pikes Peak (14,114), but as casual and gay as if we were back home on the Pennsylvania Railroad going from Washington to New York for a week end. No *soroche*, or mountain sickness, troubled us.

Soon after we crossed the divide, the country changed. Here among the perpetual clouds more moisture permitted vegetation. The slopes were covered with a lousy grass. Woolly flocks of llamas, alpacas, and occasionally the shy and gentle vicuñas grazed.

Now going downhill the train rattled and swayed. The air grew chilly, for the sun was setting. We saw more people and more farms. We were now in the midst of the *puna*, the higher section of the *altiplano*. This immense pampa of southern Peru lies between the two highest cordilleras of the Western Hemisphere* and averages more than 12,000 feet above the sea.

The sun had set behind the Western Range and it was dark as we left the train at Juliaca.

Our hotel room was on a rickety balcony overlooking a patio. There were no windows, but the cracks around the door provided plenty of ventilation.

Previous occupants had penciled their names and the dates on the walls—a sort of Spanish "Kilroy was here" covering many years.

Water was in an enameled pitcher beside a metal basin.

"Look, running water!" exclaimed Rosita.

We had it all right, for there was a half-inch hole in the bottom of the basin!

It was cold, too, for the lack of oxygen at 12,550 feet means less fuel for the blood, and we went to bed with everything but the linoleum piled on us!

Next morning Rosita, Lunati, and I took the train for Cusco. Until nearly noon we rode north and west across the vast puna.

The short, tufted grass reminded me of our

western plains. In the background rose crests of the mountains. For mile after mile these two mighty ranges paralleled the tracks.

We passed through tiny villages of adobe huts where loafers watched the train go by and women at doorways held up chunky brown babies to see the Indian equivalent of the *choo-choo*.

We waved to one man with an impulsive Mongoloid face. He was in modern store clothes, his feet were bare, and he wore the age-old Indian *chullo*, a knitted skullcap with ear flaps. On top of this an American-style snap-brim felt hat fitted snugly. Suddenly he grinned and waved courteous good-bye.

At Chuquibambilla the train passed between neat wire fences, and in the distance we saw a tractor pulling a gang plow.

"That is the Peruvian Government's experimental farm," explained the lieutenant. "Here the modern heirs of ancient Peru are taught 20th-century agricultural methods."

"Once our people ranked among the greatest farmers in the world. Other ancient peoples knew about irrigation and the use of fertilizers, but centuries before Columbus we used methods which even your own experts have studied."

"Most farms of ancient Peru were terraced. All the earth in those thousands of terraces was put there by hand, sometimes after being carried for miles from some other place. Moreover, that soil was carefully selected for its composition and fertility and placed on terrace surfaces to form 'artificial' topsoil."

"Now your experts learn from our ancients, and our moderns learn how to drive a tractor made in U.S.A."

At La Raya, once more over 14,000 feet, we passed out of the Titicaca basin and started down again. Although the change is almost imperceptible at this point, we had crossed an important watershed. A stream which had paralleled the track now was running with the train instead of against it.

"Now you are in the Amazon drainage," another passenger said. "That tiny trickle you see there eventually reaches the Atlantic, 4,000 miles away."

Grazes Grow at High Altitude

Barley, maize (called *choclo*), and a pigweed (*Chenopodium quinoa*) known as *quinoa*, which is another cereal, grow here at altitudes above 13,000 feet, watered by ice-cold streams from the mountain peaks.

* See "High Lights in the Peruvian and Bolivian Andes," 18 illus. in color by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, February, 1937.

† See "Staircase Farms of the Ancients," by O. F. Cook, NATIONAL GEOGRAPHIC MAGAZINE, May, 1916.

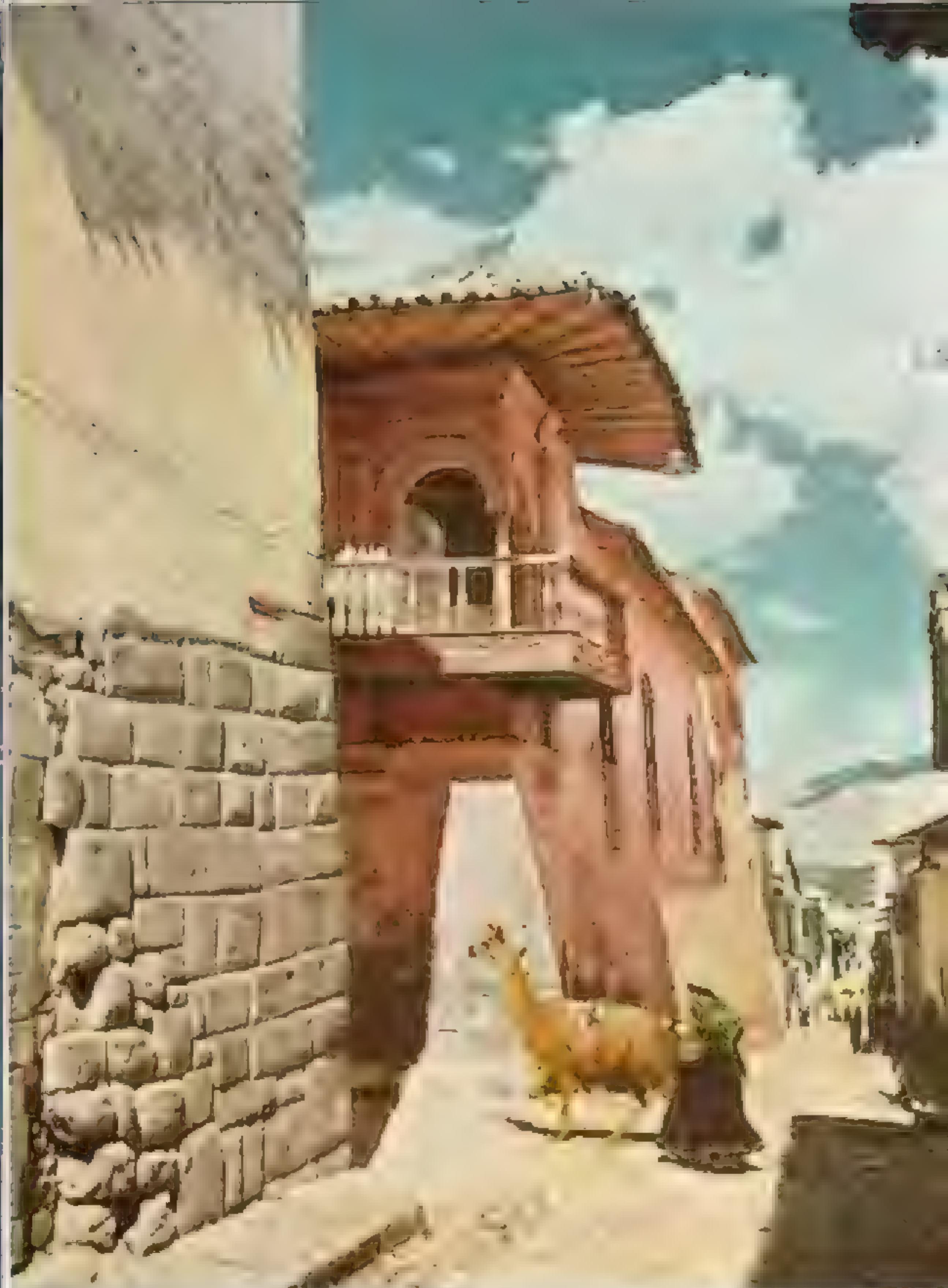


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Photograph by Kla West

Indian and Llama, Partners in Peru's High Places, Thrive in the Thin Andean Air
This Quechua possesses the huge lungs that highlanders develop to withstand altitudes where airmen use breathing aids. His blood system, laden with extra hemoglobin to absorb oxygen, has more red cells than normal.



Chichen Itza
Ceremonial Walls, Inca below and Spanish above, Blend Two Cultures in Stone and Stucco
Photo by James L. Mora, San Francisco, California



1. Very Spanish. Highways Cover the Narrow Streets. Take Out for Glasses. Then, Traffic

is at a standstill. The streets are so narrow that the cars have to stop and wait for the horses to pass. But the horses don't take orders from drivers.



Enola's Open Letter Comes Down from the Trees: Who Lived, Underage and Never

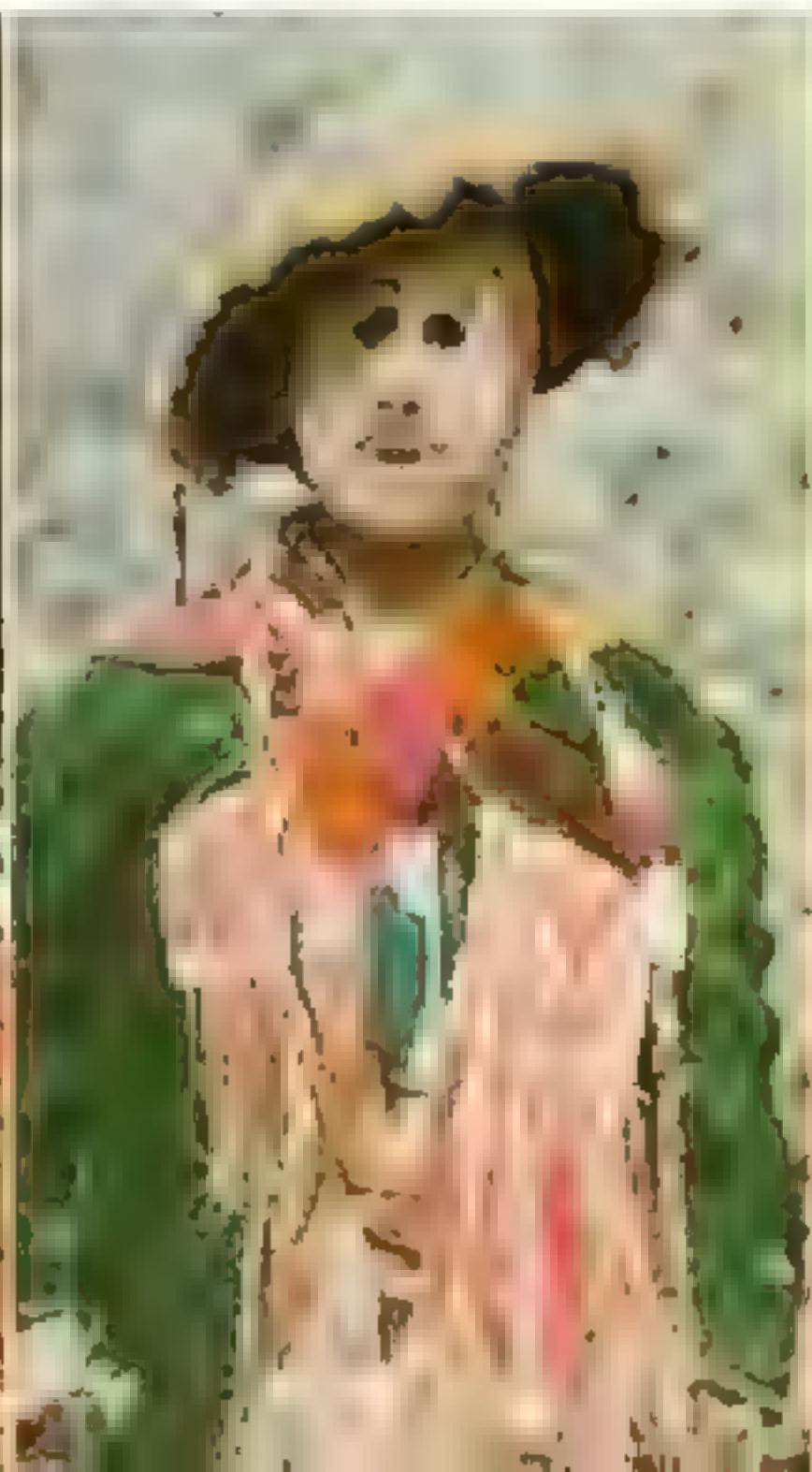
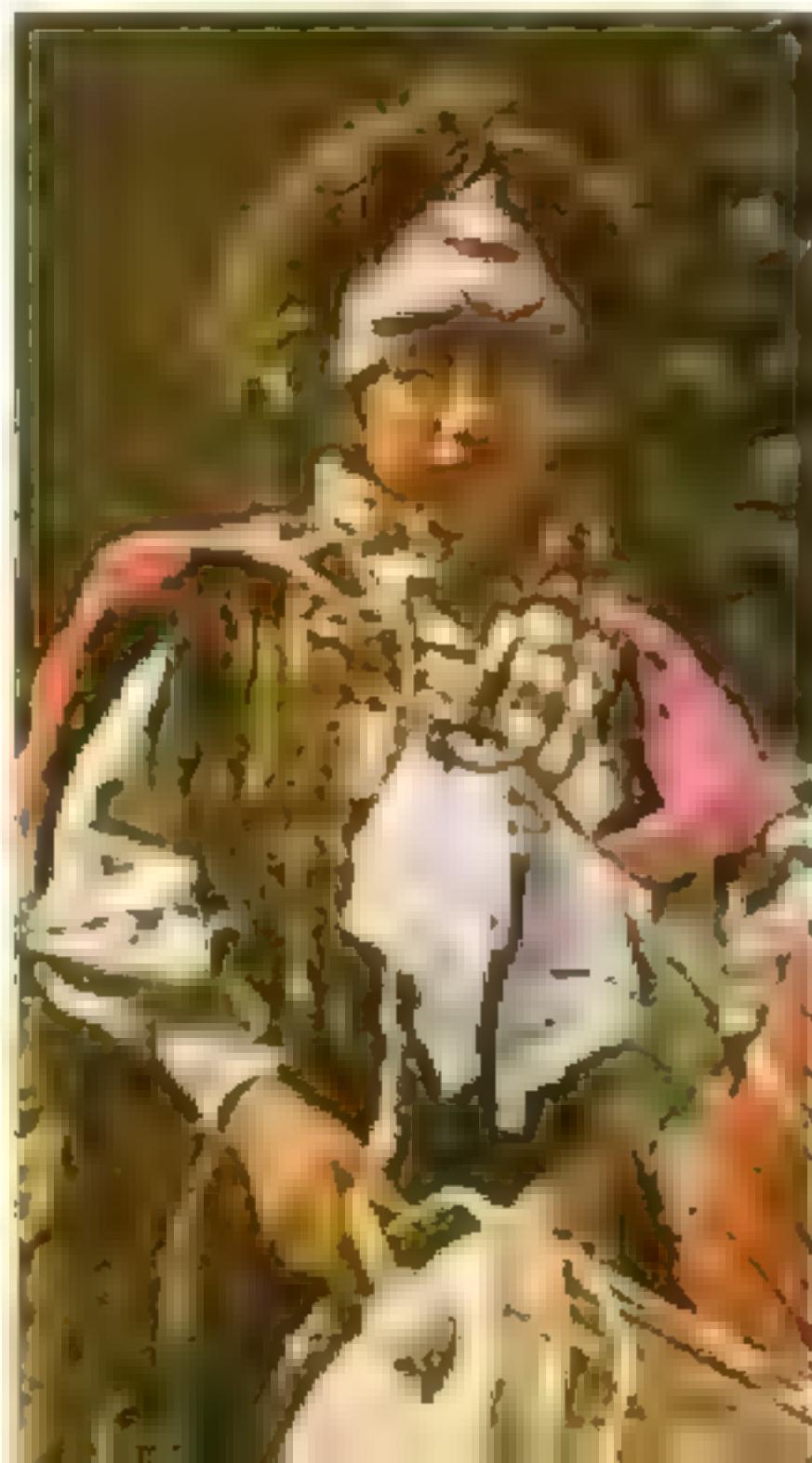


• Indians Pioneers in Fiesta Skuttle Along Road near Pisac

Indians from the Andes mountains, who have been here since the days of the Incas, are the first to arrive at the fiesta. They come from the high plateau country around Pisac, where they live in small villages. They are dressed in their traditional Indian clothing, which consists of a simple loincloth and a poncho. They are carrying their belongings on their backs and are walking along the road to the fiesta.

• A Dancer's Mass Center Pokes Fun at Spanish Monarchs

A dancer in a costume that represents the Spanish monarchs is performing a dance in the center of a crowd. He is wearing a white shirt and pants, and a tall hat. He is holding a long stick in his right hand and is waving it around. The crowd is cheering him on. The dancer is making fun of the Spanish monarchs by wearing a costume that looks like theirs.



Sierra and Andean Forests, Grasslands, and Shrublands of the Culture of Suburban Arequipa

600

600







* Jaffna, a Railway Junction Gives Lovers a Love Fashion Show

BY ROBERT H. COOPER / STAFF WRITER
PHOTOGRAPH BY RICHARD D. KELLY / STAFF PHOTOGRAPHER

* A Motorbus on Bowed Wheely Rims Between Colombo and Maebor Picchu

BY ROBERT H. COOPER / STAFF WRITER
PHOTOGRAPH BY RICHARD D. KELLY / STAFF PHOTOGRAPHER





A Peasant boy Coles Advertises for a Wife with the Flowers in his Hat

“I am a poor boy, and have no money, but I have a good heart, and a kind disposition, and I would be a good husband to any girl who would have me.”



• High-Stylish Shoes Pitch the Trend of This Choice for Indian Schools

At a public school in the hill town of Ootacamund, India, the girls in the uniformed school are wearing the same shoes as the girls in New York—modern, high-heeled pumps.

• Andean Towns Have Changed Not at All Since Their Women Used Them

In the Andes mountains of South America, where the women still live in the old way, the girls still wear the same shoes they wore in the days of the Incas.





* Indian Women in Calcutta Drink Chicha, the Men's Sprouted-grain Beer

Some 500,000 Indians drink beer. The women, who are kept out of the bars by their husbands, buy it at roadside stands and drink it at home.

▼ Sales Are Measured, Not with a Scale but by the Piles Price

The roadside stall vendor for beer in Calcutta no longer has to use a scale. Instead, he uses a pile of grain to measure his beer, and the price is based on the weight of the grain.





Indian Farmers Shaping Fields Over and the Alaknanda, the Hindus' Sacred River

Photo: Steve McCurry, National Geographic Society, 1990
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Ripening Climate Change Partners II transforms the Broad River Valley from a Golden State
to a Green State. Photo credit: Tom Stienstra, San Francisco Chronicle, November 1, 2012. Used by permission.

the first time I ever saw him. He was a tall, thin man, with a very pale face, and his hair was very long and thin, and he had a very small mustache. He was wearing a dark suit and a white shirt, and he was looking at me with a very serious expression.





Limas, the Capital of the Andes, Remains the Impoverished Indian's Foothold. Land
and water are abundant, but there is little to live on. The Indians here are
still in the primitive stage of agriculture.

Black adobe houses with blue doors and white houses with pink doors stood amid golden grain. Some houses even had red Spanish tile roofs instead of thatch or corrugated iron.

At Chactuyoc a huge yard vibrated with silver dyed wool laid out in the sun to dry. Near by was a modern basketball court.

As we left Sururi, Lunati pulled his broad shoulders back through the window.

"Here is a treat for you," he beamed. From a vendor on the platform he had bought three *anthakas*.

These were small wire spits about six inches long, strung with pieces of beef heart highly seasoned with garlic and oregano and topped with a chunk of potato. Fresh from an open fire, they were sizzling hot and aromatic.

We whiffed other fragrant odors as the day passed. Finally smoke began to curl from hills along the way, and it grew dark. We were down to about 11,500 feet now and 200 miles nearer the Equator. Trees had appeared again. We got off the train at Cusco in an atmosphere fragrant with the unforgettable perfume of burning eucalyptus.

"The Navel of the World"

To the Incas, Cusco was the "Navel of the World." Even today Indians of the Andes mutter a prayer upon coming in sight of the "Sacred City." As I looked down up at its red-tile roofs and green groves, the narrow, hill-climbing streets and numerous bell towers betokened the antiquity of the city (page 442).

Even in the modern and comfortable Hotel Cusco the venerable feel of the city is strong. Step outside and you are in a strange land.

The city lies at an altitude of 11,155 feet, in a little valley of the Mantaro River, a tributary of the Vilcanota. Its population is about 53,000, mostly of Indian descent.

The place is a happy hunting ground for historians. Recently many new ruins have been discovered.

Narrow streets, many of them less than 15 feet wide, make one-way traffic imperative. Uneven cobblestones have been replaced by two thin paths of smoother stones to provide easier riding for automobiles (pages 430, 431). Other streets have never known a wheel, for on the steep hillsides they are stair-stepped.

Most interesting of all are the walls which line these historic passageways. The Incas were master stonemasons, and Cusco, their capital, contains excellent examples of their art.*

Oscar Conrads, an English-speaking student at the University of Cusco, showed us

around the city. Like 90 percent of the population of Cusco, he also spoke Quechua.

Llamas in flocks of from two or three to a dozen or more were frequent. With haughty heads and seemingly disdainful air their tiny two-toed feet apparently scorned the cobbles. They were never led. On the contrary, they always preceded their owner and stopped or started, turned to left or right as they pleased.

Llamas Obey Indians' Signals

"Do the Indians just follow the llamas?" I asked Oscar.

He laughed. Up the street came another group.

"See if you can hear the sound the man is making," Oscar suggested. "He is telling them what to do."

The llamas passed us with the Indian trotting along behind. He seemed to be wheezing.

"That hissing noise is understood by the llamas," said Oscar. "You can't tell the difference in the sounds, but they can, and he keeps talking to them as they go along."

"Ask him to stop them," I requested.

Oscar shouted in Quechua, the man gave a sharp hiss, and the llamas, already 30 yards down the street, stopped in their tracks.

"Now ask him to turn them around and come back," I suggested.

The Indian hissed again. The llamas executed a perfect right turn and came trotting directly toward us. When they got in within about 10 feet, the man made a sound like a soft sigh and the beasts slowed to a stop!

That night we sat with Lunati and other guests before the big open fireplace of the Hotel Cusco. Instead of a tame alpaca, two tame deer had the run of the building. A package of cigarettes left carelessly on the coffee table disappeared down their throats. "Lophane and all, before you could say 'Mythia Putchu.'"

Neatest trick, however, was the way they inserted their slender noses into glasses of fiery-hot *pisco*, a Peruvian brandy somehow offered them, and lapped up the stuff to the last drop. It did not seem to affect them.

Cusco a City of Many Bells

Outside, the air was full of the sound of bells, but today, after the earthquake, most of them are silent. Cusco has more churches, convents, and monasteries than most other South American cities of its size, and their bells seemed to be chiming most of the time.

* See "Inca Empire Builders of the Andes" by Philip Ainsworth Means, NATIONAL GEOGRAPHIC MAGAZINE, February, 1938.

Early the next morning, with Lunati and Oscar, we took the road to Pisac, north out of Cusco, past the cyclopean fortress of Sacsahuaman. On the ancient Inca parade ground before the megalithic wall we saw modern descendants of the Incas playing *frontón*.

"Basketball, baseball and tennis, all those games, were introduced here by your countryman, Dr. Giesecke," said Oscar (page 421). "In addition, he was one of the first to recognize the importance of the archeology of this region, and through his efforts many important discoveries have been made. All phases of our Peruvian culture have been enriched by this remarkable Yangua."

The road to Pisac is narrow and winding. It was unpaved. Available rock had been used in places to form a stone retaining wall against the side of the mountain rather than for road surface. We commented on this.

"*Copacana*!" said our monosyllabic driver. "That explains everything," I commented.

"It does," said Oscar. "That one Quechua word means the silent swoop of an eagle upon its prey, and refers to a peculiar form of banditry we have in this region. Without warning and without a sound, the band suddenly lets go and envelops everything in its path. It's not a pleasant death."

But there was gaiety upon the highway too. Rounding a sharp corner, we came up to an early *fiesta*.

Masked dancers in fantastic costumes performed a kind of double shuffle in the middle of the road (page 433).

Only men were dancing. Smiling women watched, dogs barked excitedly, and the orchestra did some solid "singing" on a few mournful notes. Then the band stopped to wet its whistle.

Literally, the whistle was the leader, for the "orchestra" consisted of a flute, a slate and a bass drum, all homemade. During the intermission I exchanged a few cigarettes for good will and made a few pictures (page 433).

"Sacred Valley" Gem of Inca Land

Another turn in the road and before us spread the Valley of the Vilcanota, sometimes called the Vilcamayo (Sacred River), because its waters and the Vale of Vilcanota were sacred to the Incas (page 400).

Below and to our right lie the village of Pisac, with ancient agricultural terraces on the mountainside above it. Lunati pointed to the river running past the town.

"The river flows between stone walls so fields may be built right out to the river banks without danger of erosion," he said. "There

is an example of the reclamation agriculture of the Incas."

A winding road led us down the mountain and across a modern suspension bridge into the center of town (page 432).

Pisac is one of the oldest centers in the valley. An attraction is the colorful Sunday market and the strange Mass said in the primitive church of the Indians. Priests, or leaders of the surrounding clans, come to town to form an official escort for the priest. They accompany him from his residence to the church for the services and afterwards conduct him home again. They and their sons also take part in the Mass (pp. 435, 459).

As we entered the gloomy interior of the church, devoted Indians in strange attire surrounded us; their faces rapt with feeling as parts of the ritual were intoned in Latin, Spanish, and Quechua. Weird notes whirred from an antique bone-made pipe organ. A lusty, barrel-chested Indian worked frantically at the bellows. At one point in the ceremony the sons of the clan leaders startled us by blowing mournful tones on conch shells.

On an altar near us rested a human skull with a faded red flower stuck into an eye socket. It had formerly belonged to a man of the neighborhood who had done much good for the church. This was a sincere tribute from these simple

Cleanup Week in Pisac

Following the Mass, an Indian in modern dress mounted the steps to the foot of the cross in the plaza and shouted for attention. Soon a crowd of citizens stood beneath him. From a paper he translated into Quechua as he read:

"Citizens of Pisac, our city is becoming more and more a center of trade and tourism. We have become famous! From all over the world people come to Pisac. But we do not take enough pride in our city. Streets must be cleaned up, gutters cleared, buildings repainted, and walls whitewashed. This must be done immediately. Anyone who has not cleaned up his house and the street in front of it within 10 days from this date will be fined. This is an order!"

Farther down the valley we passed a young Indian carrying a toy wooden gun and followed by a black pup. At my request he posed for a picture beneath a *chicha* (native beer) sign.

As a member of the Rural Guard he wore his toy gun proudly as a symbol of his importance, but gay flowers in his hat struck a strangely festive note (page 437).

"Why the flowers?" I asked.



Tents and Shacks of Refugees Under the Pine Plant de Armas, Heart of Cusco

I think there's a lot more to be done and I expect to be involved in that over the
next few years. I expect to continue to work with the National Parks and the US Fish and
Wildlife Service and the Bureau of Land Management and the Corps of Engineers and the
Department of Interior. My job is to help them do their job better and more effectively.

Because I am a mother, a bachelorette, and they indicate that I am looking for a man.

We drove through beautiful country by back roads lined with eucalyptus, willow, and poplar. The air was soft and fragrant with blossoms.

Among the willows which overhang an island in which small green parakeets flitted, we saw many shrubby birds dotted among the blossoming flowers. As the sun sank lower, we heard the coo of pigeons.

But I was prepared for the climax of our survey, the trip to Machu Picchu, that ancient citadel of the Incas, unearthed in 1912 by a National Geo-

graphite. Society-Side University [sic] under the leadership of Dr. Biran Erdogan [page 421].

Our friend Louis [Loyd] was there coming, along with his son and daughter, a Frenchman friend we had met on the train.

I have never eaten such wonderful potatoes," said old Basila.

What would Lamont Jackson think if he could see his original hand? When the original hand was taken, it was to the Negro to prove to Mr. Jackson that he had been born white. The Negro said, "I am black, but I have a white hand." In the West Indies, the Negroes call their hands "black hands," but the white hands are "white hands."

Why is there no *big* one?
Because there's *no* *big* one.

Air Force Strategic Targets from Hitler's Valentine Boxes. The front card shows a V-2 launching site at Hamminkeln, Germany.



brought the potato to Europe they gave the world a gift far more valuable than all the gold of the Incas."

After dinner we said good-bye to him, as he had to return to his post at Urubamba. We did not see him again.

Early next morning Rosita and I, with six other passengers, crowded into the tiny yellow *automóvil* at Cusco station. The vehicle was a small autobus with an automobile motor designed to run on the narrow gauge railroad track which extends from Cusco to Machu Picchu (page 436).

We made several switchbacks to surmount the steep mountainsides which enclose Cusco. Soon we started on a downgrade which would continue all the way to the foot of the citadel, from the high, chill plateau above Cusco to the edge of the tropical area.

The Anta plain spread out before us like a plateau on a flat desert floor. Indians in red ponchos trotted along paths or roads which led to feudal looking haciendas surrounded by stately groves. Here and there a dashing caballero on a white horse rode by like a grandee of old.

Vertical Landscape Is Startling

Then we were in a canyon. The sudden transition from horizontal to vertical landscape was exciting. Almost vertical cliffs had been cut back for the railroad track along a narrow stream of rushing white water. Yellow flowers like black-eyed Susans and graceful fronds of pampa grass bordered the way.

In a few moments our narrow canyon suddenly ran head on into another slash in the mountains, and we turned almost at right angles to follow the canyon of the Urubamba. Through it flows the river we had seen at Pisac (page 446), there known as the Vilcanota.

Unfortunately we could not stop long at Ollantaitambo (Ollanta), another famous Inca city and fortress near the river. It formed one of a chain of Inca citadels which extended from Machu Picchu to Cusco.

Farther on we passed the ruins of other Inca centers—Runcatay, Wintay Huayna, Choquecasyu, Quicche. At Salapucos remains of another fortress marked the entrance to the Torontoy canyon, narrowest stretch of the Grand Canyon of the Urubamba.

Here the walls of the canyon close in. Daylight fades. Rising sheer for as much as 2,000 feet in a single step, the granite sides extend upward like the windowless walls of gigantic skyscrapers. The confined waters of the river roar and foam, casting white spray high into the air.

Orchids, ferns, and other tropical foliage covered the lower faces of the cliffs, for we had now passed through the temperate zone and were on the edge of the tropical area. More than two miles above us towered the great snow peaks of the Andes.

Machu Picchu station is just that—a tiny railroad station located on the floor of the canyon, about 6,500 feet above sea level, with telegraph, telephone, and a cramped side track switcher. At present it is the practical end of the line, although the train runs a short distance down the canyon to the foot of the ridge on which the rails stand. We coasted on down the track.

Machu Picchu at Last

"All out for Machu Picchu!" Oscar called. After crossing the blustering torrent on a sturdy bridge, we came face to face with several mules. Although we knew from the beginning that we should have to ride mules up to the ruins, our meeting was not one of mutual pleasure. We started upward.

The old city lies along a narrow ridge between 10,300-foot Machu Picchu (Old Peak) and 9,000-foot Huayna Picchu (Young Peak), which sticks up sharply to the north. The altitude of the city itself is about 8,000 feet above sea level, with many variations in level among the various parts of the ruins. Everything is up or down, and we came to think in terms of vertical rather than horizontal distances (pages 450-7).

At the top we found the Machu Picchu guesthouse, installed by the Peruvian Government. This was our home for three days and nights while we explored the city.

The site is especially valuable because it is the largest and most complete Inca city which still remains just as it was in Inca days. From the time of the death of the last inhabitant, sometime in the 16th century, it remained indeed a lost city of the dead, soon covered by the fast-growing vegetation. So hidden in the sky was Machu Picchu that colonial Spaniards never found it. Here lived the last four independent Incas, the emperors and living gods of their people, the Quechuas.

Chosen Women Secluded in Convents

In all the Andes the Inca sun god could not have chosen a more awesome setting for his temples. The city looked up at two towering peaks; it gazed down into the Grand Canyon of the Urubamba, a 2,000-foot drop.

In this stupendous setting the Incas' Virgins of the Sun, or Chosen Women, passed away one by one, leaving no sons or daughters to give the world the story of their sky-top city.



Hiram Binders Discovers Machu Picchu, Dedicates Its New Road, His Namesake
Hiram H. Bingham trudged through mountains to the ancient city in 1911. He had three Native Americans as his guides, but he escaped the Indians' green grip. Would War Dept. Fund him? No, but he had his own money. It was the legend of the lost city that took him to the backbreakers of the Andes.

Machu Picchu was the rule among the Inca nobles, who usually selected their brides from internal convents called Houses of the Chosen Women, or the Sun.

The convents, consecrated to the sun god, also trained ancient Peru's vestal virgins, the Chosen Women, to be handmaiden of the Incas. They wove his finest textiles and brewed his choicest beer. Such a convent city was Machu Picchu.

Many people do not realize that the Incas were once reduced to a shadow, subjugated by the power of a mountain retreat like Machu Picchu.

Achani, however, was the Inca's military headquarters. Vilcabamba, long established, was even sacred. Impaled by Achani, according to Spanish chronicler Alvar Nunez Cabeza de Vaca, was the Inca

name for Machu Picchu. Bowers went to the ruined city in 1911, but he did not know then what else to call it.

Nature's Formidable Fortress

To Vilcapampa the Inca Machu Picchu, from conquered Cusco with its fine temples, his bravest troops, his Chosen Women, and the sun, was his jewel.

The sun, Urquilla, Achani gave up. It was a fortress defended by some of Nature's most unpredictable ramparts. The road to their King's old capital passes 15,000 feet high and descends 5,000 feet deep. However, Spanish invaders finally penetrated the kingdom of Achani. They captured the last Inca, son of where near Vilcos, bore him in triumph to Cusco, and put him to death in 1572.

The victorious Spaniards did not settle the lower Urubamba. Not inquisitive about Vilcapampa, they seem never to have searched it out. Spaniard and Indian alike forgot the city; the jungle took over.

Senator Bingham rediscovered the lost city in 1911 after a long search through canyons and mountaintops. He was exploring Machu Picchu, the mountain, expecting to find only a significant ruins, when he suddenly faced a surprising sight—"a flight of 100 walled terraces."

Full of wonder, Senator Bingham wrote:

"I saw beautiful walls of stone houses built in the most exquisite Inca style. Moss, bamboo thickets, and even trees buried the ruins, but I could discern granite ashlars still fitting together as perfectly as though they had been laid the day before."

"I stared at moss-hung ruins—temple after temple, surprise upon surprise. The sight fairly took my breath away."

Machu Picchu was a tremendous natural fortress. A handful of men could have guarded the approaches. Signal stations stood on the twin peaks. Man-made walls, reinforced by a dry moat, enclosed the city limits. Only the Inca, his nobles, priests, and the Chosen Women were permitted to pass these barriers.

Stairways Connect City Terraces

Completing preliminary explorations, we returned to the United States. That winter (1911-12) the National Geographic Society and Yale University agreed to back an extensive survey.

"The next season we completed the spade work and examined Machu Picchu in detail.

"The city was built on the saddle of a mountain ridge and the steep slopes immediately below."

"Space was so limited that houses were crowded together on narrow streets."

"Terraced city levels were linked by 100 or more stairways. The longest of all, with about 200 steps, divided the city in half and served as its principal thoroughfare. This precipitous main street we called the Stairway of the Fountains because it was the site of a series of basins."

"The finest staircase of all led to a little hilltop commanding the city."

"Here our expedition found a fine stone *intihuatana*, a sanctuary where the Inca priests 'revered' the solar deity and 'led' him down. One can picture the nobles, priests, and Chosen Virgins ascending the granite steps on festive days and blowing kisses to their fiery deity."

"One windowless, gaule compound of beautifully built houses appeared so palatial that we called it the King's Group. We can imagine the palaces furnished with vicuna wool rugs and other soft textiles woven by the Chosen Women."

"One small building we named the Sun circular Temple because its outer wall was bonded to a curving rock. So closely fitted were the mortiseless granite ashlars that they seemed to have grown together. They held by friction, not unlike the glass stopper in a bottle."

Where Incas' Mummies Were Worshiped

"On a spot which I called the Sacred Plaza we found two fine structures which were left completely open on one side so that the sun might shine in."

"The larger structure, which we named the Principal Temple, contained a 14-foot-long block, which appeared to have been a ceremonial throne where mummies of departed Incas were brought out at regular intervals to be aired and worshipped."

"Our Indian workmen, spurred by bonuses, discovered more than 50 caves and tombs. Not one of these gave up any gold or other common 'treasure.' A solitary green glass bead was the only indication of previous contact with Europeans."

"Cemetery caves yielded 173 skeletons. Of these, females predominated in a ratio of 10 to 1. This significant discovery showed beyond doubt that Machu Picchu had indeed sheltered the Virgin of the Sun."

Tomb Yields Bones of a Mammachu

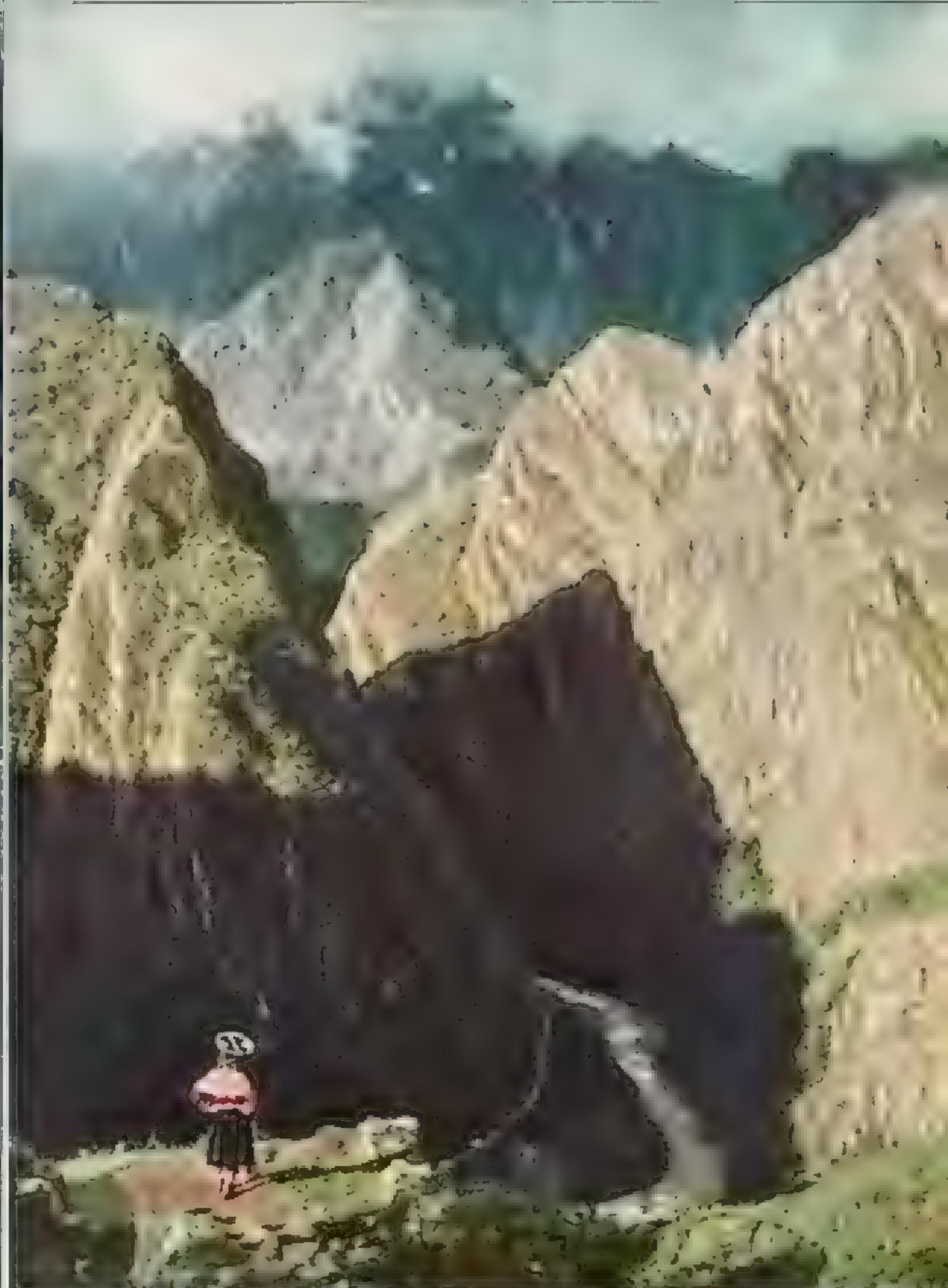
"One day we unearthed the burial place of a *mamacuna*, or high priestess, the superior of a convent. Her calling was identified by a concave bronze mirror such as mamacunas used to ignite tinder by focusing with it the sun's rays, to the mystification of the superstitious laity."

"The exciting discoveries of 1911 and 1912 led me to undertake further studies of Machu Picchu in 1914-15, which were financed chiefly by the National Geographic Society, but World War I stopped our visitations. I did not return until recently, when the Peruvian Government invited me to attend on October 17, 1948, the opening of the *Cerro de la Luna* Bingham, the new five-mile motor road which climbs the slopes some 1,250 feet to Machu Picchu" (page 451).

There is nothing spooky about the place today, we found. Several families of laborers live among the ruins, keeping the underbrush cleared away.



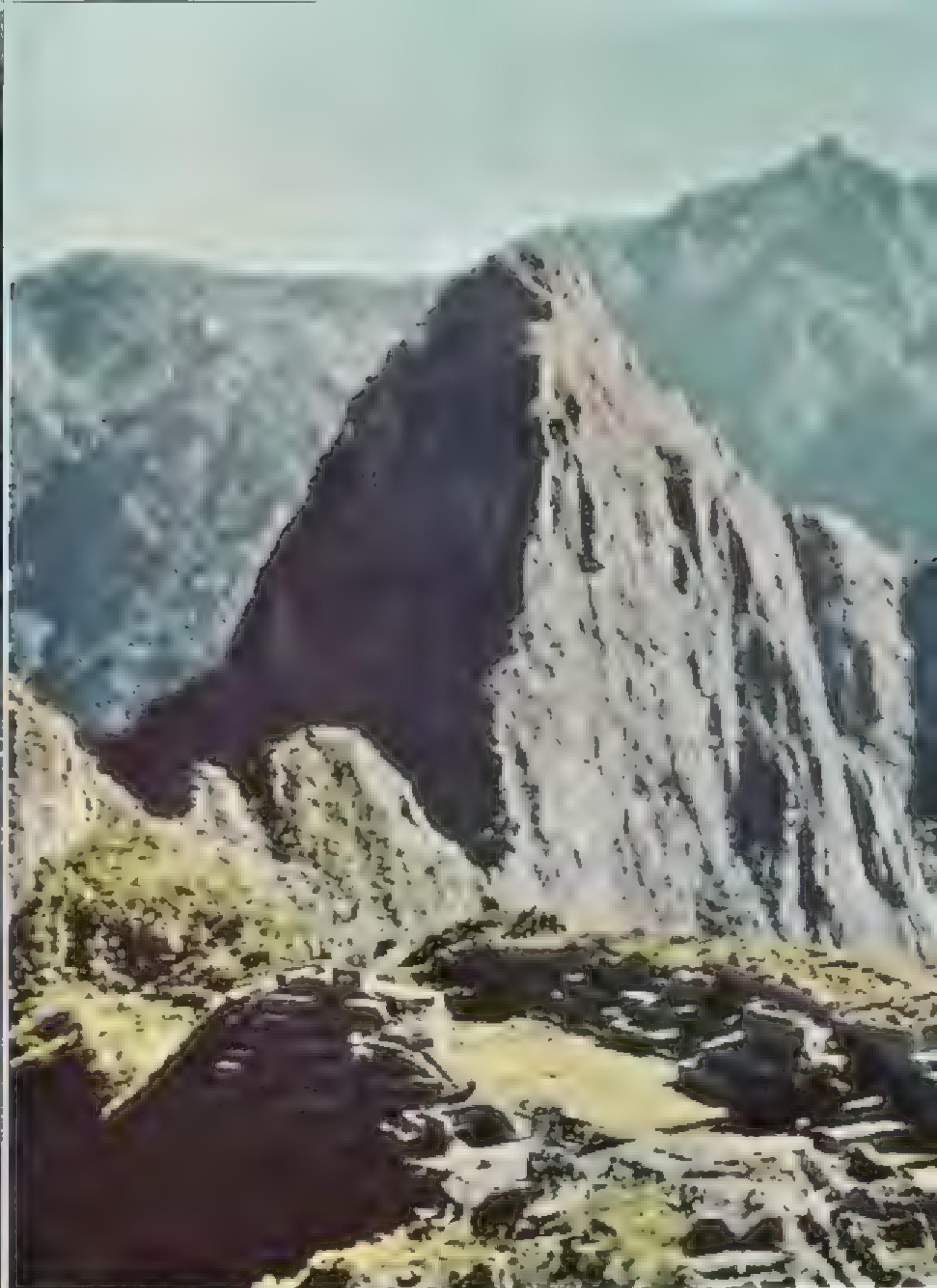
A Final Message on Indicators: His Fare from Texas, His Costerings from Colombia, Spaniards



Macho Picchù, the Inca's best Condor, looks down 2,000 feet into the Roaring Urubamba River valley below. The condor is the symbol of the Andean culture, and the Inca believed it was the messenger of the sun.



Alameda Valley Masons and Ad. James Clark. Seated St. as Symbols of Office
C. 1880. (Courtesy of the Alameda County Archives)



Machu Picchu, Sanctuary of the Virgin of the Sun, Clings to a Ridge 5,000 Feet in the Andes. In the foreground is the small stone structure known as the Shrine of the Virgin of the Sun. The city of Machu Picchu lies below, hidden in the mist.



Empty Temples Stand Through Thatchless Roofs at a Sun Worshipped by the City's Builders

The Chinese believe in the sun as the central deity which controls the earth. Every year they celebrate the sun's birthday with a great festival.

Well-Care Stretches the Vascular Integrity of Corked Bark and Stem
in *Populus tremuloides* (Trembling Aspens) in the Colorado Rockies



State Reserve in Israel & Judea. West side. View in front of David Chaidler, the British





Fig. 1. Annual Snows of Cordillera Vilcabamba Overlook a Semitropical Valley at Urubamba
Hacienda. The slopes of the mountain are covered with the vegetation of the semitropical valley, and the snows are collected in the high mountain. The snows are collected in the high mountain.

At the guesthouse the food prepared by Lettis Paezo, the cook, was delicious, although we were told she was "not feeling well."

Next day we learned the reason.

About 2 o'clock in the morning a subdued commotion overhead roused us briefly, but we soon went to sleep again. At breakfast the manager was smiling.

"Last night the cook had a baby girl," he announced. "The first baby of modern times to be born on Machu Picchu. Her name is Doritila Estanislao Incacahui Pinedo."

After breakfast the next day Ira Juarez, who had rejoined us, Oscar Gonzales, and I climbed several hundred feet above the city and surveyed the ruins from high up the slope of Machu Picchu Peak. From an ancient cemetery we had an impressive view of the entire city (pages 456-7).

Machu Picchu is famous for lighting effects. Because of peculiar climatic location on the edge of the tropical zone, the city might be said to stick up into the Temperate Zone, while the lower slopes are in the Tropics.

A Night on the Mountains

A night on Machu Picchu is never to be forgotten.

As the huge red sun rushes down beyond the rim of western peaks, the ancient granite gables and towers fade from gold to black, and clouds brush the tips of neighboring mountaintops. Unfamiliar night smells of tropical vegetation float upward from the canyon, and, as the skies clear, the world is filled with strange stars unseen in North American latitudes. Beyond the black saw-toothed outline of the Inca citadel blazes the Southern Cross.

In the morning the cooler air above the canyon is warmed by the rising sun and lifts to make way for the humid air below. As this moisture-laden air ascends, it cools and condenses, so that observers at Machu Picchu look out horizontally upon mysteriously forming clouds which take shape before their eyes, shift, rise, and disappear above the airy peaks.

Literally, the aim of a visit to Machu Picchu is the climb to the tip of Huayna Picchu, the sharp peak which dominates the city. I was determined to stand on the very top. Oscar had climbed it once before, so he led the way.

Beyond the main part of the city and the base of the peak lies an area of junglelike growth through which we had to fight our way to the narrow ridge between the two. Here we stumbled over mere ruins still uncovered and unsuspected by the average visitor.

Among the scattered stones grew tall grasses which hid sudden pitfalls. Vicious-looking red and black millipedes more than six inches long were everywhere underfoot.

Afterwards I learned that this area is a favorite of the dreaded fer-de-lance and bushmaster, as well as the lethal coral snake, all of which strike without warning. Luckily I saw nothing of them.

Orchids of many varieties were always just out of reach.

Stout Wire Aids Climbers

Some unknown but considerate person had rigged a stout wire along the sharpest edge of the narrow knife edge to Huayna Picchu. Without this the way would be almost impossible. A drop of hundreds of feet is on either side.

From there on, however, the climb is just hard work. From any distance the clifflike sides of the peak look sheer, but a tiny trail has been there since Inca times. This narrow path zigzags upward so steeply that in some places a rock, dislodged from the bend above, will clear the trail below and fall clean for hundreds of feet.

The trail was so overgrown with grasses and ferns that often we had to feel our way. Several times it narrowed to a foot in width while climbing steeply. Even this scant foothold was sometimes lacking where small caverns had caused V-shaped apertures fringed with long grasses. We cut long sticks and proceeded before us like blind men.

During frequent stops for breath I saw many forms of bird life. I recognized tanagers and flycatchers and hummers swifts. One soft gray fellow with a black head Oscar identified as a grosbeak.

"The fertile Urubamba Valley is a natural habitat for birds," said Oscar. "Even from North America they fly over Machu Picchu."

Dangling at 1,500 Feet

The trail higher up was bare and moist. Suddenly I slipped. Strangely enough, I wasn't scared. Somehow, as I started over the edge I grasped a thick tendril and found myself sitting with feet dangling out over nothing. Beneath my soles swirled empty space for at least 1,500 feet. Far below curved the Urubamba. I looked up into Oscar's pert face, and it was then that I felt fear. After I cautiously regained my feet and paused to overcome my shakiness, we went on.

Two hundred feet from the top came a surprise. Here, at one of the steepest parts of the climb, just when I wondered where the



A Worthy Windowside Partner Thrusts In His Wedge and Gobbles a Hot Buttered Roll

On the left, Mr. Bingham holds a wedge which he has driven into a rock to hold it up so that he can get at the interior. On the right, his partner, Mr. Frank, holds a roll of bread.

we could not turn around and had to go back to where we knew there was a way out. By the numbers and the compass we safely descended once again.

A little later and we found the slanted entrance to the great wall. This was about 10 feet wide. The entrance led down a short distance and we were soon in the tunnel.

The granite boulders capped the top. The boulders had been broken by the water and ran across the rock like a comb. Below the boulders we had been hollowed out to form a bedding place.

An Idea Serves Post

Slightly lower among the same boulders we saw a crack at the very edge of the cliff. Had we not got through the hole in the side of the mountain enough for one person to stand and hold on top

He had cut the backs of the trees holding back the wall giving the entrance.

I followed to the right I could tell from the sound of the water, with only one person knowing about the place. Mr. Bingham held the roll of bread and I saw him drop it. I was surprised to see him jump over and me out into the water about 10 feet away.

Off to the left was a small ledge. From this height the enduring boulders were broken and set. Only a few of them brown marked the ancient edges of the great trees near us. Farther to the left were scratches in the mountainside identical to the ones I had named for Dr. Bingham the day before. I took my gun and went to the entrance and was about to jump into the water when I heard a noise.

"I'm coming," I heard. "I'm coming." It was Mr. Bingham, who had come to help me out.

Puya, the Pineapple's Andean Ancestor

By MERRIFORD B. FOSTER

THREE WITNESSES the dramaticowering of the most colossal of all the herbs, I flew 6,000 miles from Florida to the heart of Bolivia. There, high in the Andes, a mile and a half above the sea, I found a giant herb of fantastic proportions, the *Puya raimondii*, largest of all the bromeliads in the world.

When the layman thinks of herbs, he probably has in mind such familiar aids to cooking as thyme, mustard, or marjoram.*

Botanically, however, herbs are classed as seed-producing plants which do not have a central woody structure, as do our trees and shrubs.

This herb was a towering specimen standing in solitary grandeur, with its feet in the rocks and its head in the clouds.

Where else but in a dream could one expect to find an herb more than 30 feet high? The lowest stalk alone is some 20 feet long, with a circumference of 8 feet. My mind had difficulty in accepting what the eye and camera recorded (page 469).

When Giant Puya Blooms, It Dies

My previous knowledge of *Puya raimondii* was limited to a botanical description and a photograph published in 1911 in a German work. I had long felt the urge to go see such a curiosity. Now the dream was a pilgrimage.

Fortunately, after correspondence with Dr. Martin Cárdenas, I had been able to time my visit with the flowering period of the only survivor in this vast locality, many miles from the other three known groups of these plants, one in Bolivia and two in Peru.

Not in the memory of anyone in the vicinity of Cocharumba had *raimondii* bloomed before.

The flowering period is its swan song, because, when *raimondii* shoots its great compact columnar flower head 30 feet or more into the air, it is the first and only time it will bloom. And it takes nearly 100 years to reach that climax.

Three days after arrival in Bolivia we finished preparations for the trip to Cuesta de Huakaqui, which means in Quechua the "Slope of Going to Cry." Early in the morning of November 13, 1948, Dr. Cárdenas and I with three local helpers started out from Cocharumba on that memorable trip.

Dr. Cárdenas is the outstanding botanist

* See "Spices, the Essence of Geography," by Stuart E. Jones, NATIONAL GEOGRAPHIC MAGAZINE, March, 1949.

in Bolivia. He knows the high Andes, its plants, its Spanish and Indian peoples. Having part Quechua Indian blood, he speaks that language besides several others. He was a fellow at Cambridge University, England, before he became president of the University of Cochabamba.

Cocharumba nestles on the eastern side of the Bolivian Andes, the broadest part of the Andean range. *Cochi* means "like" in Spanish; *bumba* is a corrupt form of the Indian *pampa*, meaning "plain"; thus the name implies a "lake of plains." This situation makes Cocharumba an agr cultural center.

The mountain Huakaqui rises to about 8,000 feet. It is rocky and dry, with very little vegetation.

Fire Ladder Borrowed to Climb on Herb

An hour or so before reaching our destination we stopped in a village and went to the local fire department. I supposed the visit was for some ordinary permit, but it proved to be for a very special permission. We desired the loan of the firemen's longest ladder. Dr. Cárdenas facetiously suggested that they postpone all fires until our return, possibly the following day.

The firemen allowed us to take the ladder, and we proceeded on our climb high on those parched and brown rocky slopes, wondering all the while how it was possible that so arid an area could sustain such a giant plant.

The last few miles were a strain on the old truck which transported us wearily over the last hill and around the last curve till we were startled by the sight of an imposing isolated sentinel, the great *chiqui k'oro* ("strong puya"), as the Indians called it. To us it was a noble specimen of *Puya raimondii*.

For miles there was little vegetation to be seen in those great stretches of barren rocky wastes; yet there on the mountain Huakaqui was a solitary "candlestick" to celebrate my 60th birthday.

First to Photograph Giant Puya in Color

This plant had sprouted from a small winged seed nearly a century before I was born. It had withstood high winds, shifting of rocks, rarefied air, and blistering sun. Its charred trunk gave evidence that it had survived the fires which Indians frequently set.

I was humbled before the dignified giant. I was to be the first to photograph in color and record on motion-picture film this mammoth of all the herbs at its blooming period.



A Native Maya Shares a Bleak Domain with a Local Cenote Climbing Mothlike in a Rock

in the Yucatan Peninsula, Mexico. The man's name is Tzotzil, and he is a member of one of the last surviving groups of Indians in the Americas who still practice their ancient religion. He and his wife live in a small hut near the base of the rock formation, which is part of a limestone plateau. They grow corn and beans and raise chickens. They also hunt and fish. They are poor but happy people.

Only four previous botanical records had been made since its original discovery in 1870 by Antonio Raimondi, an able Italian botanist (1825-90).

Imagine a trunk 10 feet high topped with a thick rosette of narrow, heavily spined leaves 4 feet long, from the center of which rose a flowering stalk 8 feet in circumference and over 20 feet long, covered with thousands of waxy white flowers. The over-all height of the plant was more than 30 feet.

30-foot Giant Bears 8,000 Flowers

The 20-foot central cluster contained hundreds of 18-inch branches radiating from it like the spokes of a wheel. In turn, each branch contained numerous shorter white 3-inch blossoms radiating in a similar manner but extending to the end. In all, there were more than 8,000 flowers (page 470).

The tip of each flower branch is barbed and serves as a convenient resting place for hummingbirds after they have supped on its nectar.

Although I had tried to picture the dimensions of this unique bromeliad, the experience of standing at the foot of one in full bloom was so overwhelming that I could think only of such whimsical tales as *Alice in Wonderland*. The miracle here was all the greater when I realized that the tallest growth of other plant life in this area as far as we could see was not over two feet.

After much effort we managed to place the ladder to reach above the spine foliage, and from there on up it was really a Jack-and-the-beanstalk climb. It was lucky we had brought a ladder, for otherwise we should have had to ruin the plant to procure some of the flowers.

With shoes off, one of our Indian helpers climbed up the huge column, flower by flower, gingerly stepping on and grasping the flower stems until he reached the freshest blossoms near the top.

We did not solve the mystery of the location of this solitary plant, for it was far from the known present range of this species. Not another plant of any age or size was to be found in that mountain of Going-to-the-Sun. And now, this plant with its flowering period nearly over, was soon to return to the earth.

Mystery of a Wandering Plant

Was this lone plant a survivor of a former large colony here, or had the wind carried the seed from a group on a far-off mountain? Neither surmise seemed plausible. The rocks here are Devonian instead of the granitic formation in which the other puyas of this species thrive. Furthermore, the spot is some

300 miles from the nearest existing group of *Puya raimondii*.

Perhaps an Indian had brought the puya there as a small plant to serve as a torch for his grandchildren to fire on some fiesta day. Unfortunately, this practice of burning the dry plant and flower stalk, full of seeds, has destroyed many of these once-bromeliads (page 470). To celebrate a fiesta with flames shooting 50 feet into the air is a temptation not to be resisted!

Several months after our visit, Dr. Cerdas sent a helper there to procure seeds for me. It was too late. The giant had crumpled to the ground, having been burned before the seeds had ripened.

Most of the other species of puyas grow in big groups; thus a single plant produces many flowering heads on creeping trunks. These send forth new offshoots each year, creating a massed group often covering a large area.

I have found a few species in the bromeliad family, such as *Puya raimondii*, which are true monogamous—plants which develop no offshoots either before or after their maturity.

Puya Seeds Have Little Chance

These particular species bloom but once, then die after their seeds have matured; their propagation depends entirely upon the few seeds which germinate from the millions dispersed by the wind. Just a few might find a protected crevice where a bit of humus has been caught.

Not even one chance in a million do these seeds have of surviving and becoming a mature plant, for survival means a never-ceasing endurance test, a fight for life which starts from the tiny seed, little more than a quarter of an inch long, and culminates in the 150-year-old plant which we had come to see.

Fire, frost, wind, relentless sun, some snow, and almost no rain—these are the hardships this plant meets when trying to grow on a so-called barren mountainside.

Lower on the side of the mountain grew another puya of a different species, *Puya tunerosa*, a dwarf (rarely over 18 inches) compared with the lofty *raimondii*. This small one grew in profusion among the rocks. It might have been camouflaged from view so nearly rocklike was its coloring, had it not been for the brilliant little red flowers appearing upright and sparkling like birthday candles over the bronzed head.

The genus *Puya* is primarily an Andean group, with a few outlying species found near Santa Marta de Dota, Costa Rica, in the Sierra



M. L. RICHARDSON

Puya *Paradoxa*—Sugary Heart Grows in Indian Drink Called "Juice of Red Water"

For a great ten minutes the plait stiffened, its unbroken relapse the tempo of a slow, all-fired-in-music dance, as I watched the woven cloth. Then, with a final, rhythmic beat, it burst into life again, and the pattern was complete.

Now I was in the Andes, and on Mount Kauca in Colombia.

More than 100 species have been found by plant explorers in the past hundred years—but them growing in bleak, barren areas like this. Rich the endemic *Puya dasylirionoides* grows at 10,000 feet in wet, swampy areas—

but water never flows. The situation is not common among puyas, which are generally known as dry land plant life.

While botanizing in Colombia I found this seemingly out of place. On the heights

in Sierra Nevada de Santa Marta, that majestic and very old South American range much older than the Andes, we found several species of puyas growing in wet, moist areas, their roots submerged in deep beds of silted-up peat. On the hills above marshy grasslands, where wild horses have roamed for many years, the puyas mark their water holes just below the glittering slopes.

The puya, oldest genus of the bromeliad family, were, I am convinced, originally swamp plants growing along the western coast of South America, and were gradually lifted up when the lofty Andean range rose in one of the most extensive face-lifting operations of recent geologic times.

Flowers Clothed to Resist Cold

In spite of the heights to which these mountains have risen, the rivers have kept pace. With pure Andean tenacity they have adopted themselves to elevations as much as 14,650 feet above sea level; there I found *Puya raimondii*, a new species (pages 474 and 475).

Up there the plants are prepared for cold weather: their gaudy turquoise or yellow flowers are generally embedded in tufts of rich brown wool. Like the llama, the Andean Beast of burden, these puyas enjoy

those high snow-blotted minuta peaks and are similarly clothed to endure it.*

In all my extensive exploration for bromeliads I have found no puya that lives at any elevation below 7,000 feet.

As one of the bromeliads, the puya belongs to a large plant family, the Bromeliales, containing nearly 50 genera and more than 1,600 known species, most of them tropical. All but one are native to the New World; 19 live in the United States.

Pineapple and Spanish Moss Cousins

adapted to hardships, the bromeliads flourish in sun or shade; in deserts, on oceansides, in swamps or jungles; on rocks, bark, or palms. Fine clouds of bromeliads beard our southern forests and dangle from telephone wires with no visible means of sustenance.

This great family usually goes unrecognized by the nonbotanist, who refers to its spiny-leaved members as "cacti." But, whether he recognizes it or not, the Layman sinks his teeth into a juicy bromeliad whenever he eats a pineapple, the globe-trotting *Ananas comosus*. When he rests on a cushion, he may sink into another bromeliad, *Tillandsia usneoides*, Dixie's Spanish moss.

These two represent the extremes—the terrestrial pineapple, rooted in earth; and the epiphytic Spanish moss, a rootless air plant. Most bromeliads have roots, but in many species these serve not as mouths but as props for the upright plant, which absorbs food through its leaves.

Bromeliads developed their air-feeding habits, it is presumed, when, encountering dark, choking jungles, they took to tree tops for survival, not as sap-sucking parasites but as self-providers. One tree-living species, *Aechmea conifera*, weighs up to 125 pounds.

A Puya Eaten Like Celery

After returning from Huakaoi in Cochaamba, we made a hurried trip to the near-by mountain Tumari to collect other puyas, and especially the *borka*, a bromeliad (*Tillandsia usneoides*) the heart of which is eaten by the natives as we eat celery.

After crossing the pass at the foot of the snowcaps, we reached 14,000 feet. Here the snows are frequent but light. The peaks above are continuously shrouded in white.

Settlements are scarce. Except on a few scattered privately owned llamas ranches, there is no human habitation. Though domesticated llamas often wander far from habitation, they return to their shelters at night.

A person from other lands shivers in the high, cool, thin air, while the llama and the

Indian are well adjusted. The atmosphere is so clear that the visitor sunburns easily.

The largest vegetation in most of these areas consists of the still thy Andean puyas or low-growing cauli, which, strangely, are related to those found in Argentina and Mexico.

Starting our descent, we reached a still glittering lake formed by melting snow. We tested the temperature of the amazingly clear water where we saw swiftly darting trout.

Within a few hours we had gone steadily down to Morechita, a town of over a thousand people. All were housed in mud, stone and grass-thatched houses.

After a night here we dropped down into a valley 3,000 feet below where a moist and more fertile area greeted us. Here vegetables thrived; flowers, vegetables, and grains were encouraged. This was a welcome change from the cold *puna*, the name for the higher, bleaker parts of the Bolivian plateau, where we slept under five coarse twill-like blankets.

Descending Ladder of Vegetation

To experience even greater changes in vegetation, we crossed over the Eastern Cordillera for a collecting trip down into the tropical rain forest area in the deep valleys far below Cochabamba to the east. Much of the way was slippery for a truck; it was dangerous to travel without chains on the tires. For a sightseer it would be a most uncomfortable trip, but for a botanist it is paradise.

Every few hundred feet down from the cold, foggy, windy crest brought new plants. The trees were higher, the growth denser, the greatest change in plant families being from the low-growing plants resembling the huckleberries, at the top, to tropical growth below.

Here, on just one slope of the Eastern Cordillera, could be seen the whole range of floral families covering the coastal area of North America. Starting with plants typical of the cold states of Maine and Vermont, one can get down into Pennsylvania, Maryland, North Carolina, and Florida-type plant life by vegetational changes within a few hours' travel.

As we approached the Florida temperature zone and subtropical growth, we encountered small avalanches. Things began to look discouraging: each avalanche was larger than the last one, and a mean rizzle was falling.

Just ahead, a recent avalanche had piled a mass of rocks, soil, trees, and shrubbery 15 feet high, shutting off the only possible way of travel. The road was barely wide enough for a truck, and the sheer drop of 2,000 feet to our right was not inviting.

* See "Carnets of the Clouds" by W. H. Brewer, National Geographic Magazine May 1946.

What to do with the truck? There was no turning around. How the driver managed to back the truck up the mountain about hairpin turn after turn, until we reached a space large enough in which to turn around, I shall never know. Under such dangerous circumstances the South American driver seems to be at his best. In spite of a terrifying experience, we arrived safe in Cochabamba late that night.

A Thrilling Flight Across High Plains

For my second experience with *Puya raimondii* I flew from Cochabamba to La Paz, capital of Bolivia. The flight across the high plains north west of Cochabamba was thrilling.

With letters of introduction to Bolivian Government officials, I was able to arrange a trip to the ancient granite mountain called Comanche. Since the authorities were interested in my suggestion to add more native flora such as puyas and cacti to the new botanical garden, they gave me every assistance.

For miles as we crossed the desolate *puna*, we traveled due west in the direction of Potosí, then turned south. In the distance we could see the hazy blue of earth's highest steamer-navigated mountain lake, Titicaca, lying at an elevation of 12,500 feet. Here the sun and the moon were born, according to Aymara legend.

More than 110 miles long, 30 miles wide at its greatest width, and 1,000 feet deep, Titicaca is surrounded by mountains. Within its perimeter are several sizable islands, Coati and Titicaca being the most important. The water remains so cold that a man who capsized from his fragile balsa craft would have no chance to swim far before being paralyzed (pages 483, 494, 495, 496).

Cold and Depressing Is the *Puna*

Dismal monotony in the vegetation of the landscape greets the eye in this *puna* area. I saw no tree. Very short yellow brown *ika* grass covers the ground without the usual sparkling green. Sparsely scattered, a few bellious amaryllids seem to survive, although they remain underground most of the year.

Here and there we spotted a few low mounds of "mosses," which are not mosses but relatives of our sunflower. These are miniature compact shrubs covered with thousands of tiny white flowers. They form mounds lighter than ordinary mosses, fluffing the earth to keep out of the drying cold winds.

A salt-lined river, the Desaguadero, courses slowly over the flat land from Titicaca to Lake Poopó. It is a lazy, thirsty, shallow river that looks as if it had never had a really good drink. Often wide but rarely deep, it looks

more like the wet trail of some prehistoric giant reptile.

The climate is just as cheerless and monotonous as the landscape. A constant raw, chill wind and meager dung fires in a poorly built shelter are hardly conducive to a cheerful soul. Undoubtedly this cheerlessness has influenced the Aymara Indian's taciturn character (page 480).

Sources of food and water are meager. Dried roots and manure are used as fuel.

The lowly Indian who shares these lonely, bleak spaces with puyas and llamas would find it difficult to accept lower altitudes with fertile soil and easy living conditions.

Everything up here seemed either the delest or the longest, the hardest or the coldest, the smallest or the loneliest.

It was hard to understand how our Indian helpers, clad in scanty attire and barefoot, could tolerate the cold of this early morning as they rode in the back of the truck where the only windbreak was provided by the bodies of their fellow.

Although warmly clothed in red flannel, woolen shirt, heavy suit, extra coat, sweater, and a rubber raincoat over all, I was bug-gle myself to keep my teeth from chattering. And I was up front beside the driver with a hot engine to keep my feet warm!

40 Giant Puyas All in Bloom

At long last in the distance we saw our objective, Comanche. Out of the vast plain extending far beyond vision jutted this time-hewn granite mountain in splendid isolation, covering a square mile amid the miles of barren wasteness. It appears to be out of place, for there is nothing else like it as far as the eye can see—and you can see far up there.

That ancient mountain gradually reveals an amazing picture. Grouped here and there among the giant granite boulders were nearly 400 plants of the *Puya raimondii* in varying sizes. I counted 40 in bloom!

What a sight! The solitary, isolated specimen near Cochabamba had been a thrill. Now 40 times that! I was overwhelmed. No Indian hand had planted this colony (pages 464 and 478).

How could these mammoths of the plant world survive where there was so little sustenance? No other plant on this mountain, with the exception of one lovely golden columnar cactus, *Tribaccaus bergerianus*, grew to be over three feet high (page 475).

Surrounding some of these gold-spined cacti were clusters of blue and violet lupine set off artistically by the orange-petaled, daisy-like coreojo.



Eremalche Clappii, the Pine Bearstick. It Blooms Once Once in Six Years Then Dies.

It is a native of the desert regions of California, Arizona, and New Mexico. This is the flower specimen from a locality just to Arroyo in the Big Horn Arid.



Climate of 15 Years of Growth from the Lower Head

Now we have a better understanding of the
problem of the two cultures. We can see
that the two cultures are not really
so different after all. They are both
interested in the same things: the
same kind of knowledge, the same
kind of power, the same kind of
control over nature. The
difference lies in the way they
achieve these goals. The
scientific culture uses reason
and logic to arrive at its
conclusions. The cultural
culture uses intuition and
imagination. The scientific
culture values precision and
accuracy. The cultural culture
values creativity and
originality. The scientific
culture values objectivity and
detachment. The cultural culture
values subjectivity and
involvement. The scientific
culture values rationality and
logicality. The cultural culture
values spirituality and
intuition. The scientific culture
values materialism and
practicality. The cultural culture
values idealism and
spirituality. The scientific culture
values progress and
development. The cultural culture
values tradition and
continuity. The scientific culture
values science and
technology. The cultural culture
values art and
culture. The scientific culture
values rationality and
logicality. The cultural culture
values spirituality and
intuition. The scientific culture
values materialism and
practicality. The cultural culture
values idealism and
spirituality. The scientific culture
values progress and
development. The cultural culture
values tradition and
continuity. The scientific culture
values science and
technology. The cultural culture
values art and
culture.



The Botany of Authoritative Books for Specifying the Indian Herbs

Thompson's
Theatre
New Haven





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WILHELM. Drei Freunde fügten sich bei den Jägern, und sie gingen nachts

zu dem kleinen See hinunter, um die Fische zu betrachten. Sie sahen einen kleinen Teich, der von einem kleinen Bach gespeist wurde, der wiederum aus einer Quelle entsprang.





The Dragonfly—Master of the Skies: Poetry in the Creation of His Powers

By JAMES R. HARRIS
Author of "The Dragonfly," "The Hawk," "The Owl,"
"The Sparrow Hawk," "The Kingbird," "The Nighthawk,"
"The Hummingbird," "The Bee Hawk," "The Woodpecker,"

The Dragonfly—Armed with Powers, Unfolded in His Sudden Flight

By JAMES R. HARRIS
Author of "The Dragonfly," "The Hawk," "The Owl,"
"The Sparrow Hawk," "The Kingbird," "The Nighthawk,"
"The Hummingbird," "The Bee Hawk," "The Woodpecker,"





Practical Examples: Like Sentimental Duties, Free vs. Taxed Powers Between States

The present Bill amends the National Home Security Act to provide that the Secretary of Defense may, by regulation, establish a program to provide for the payment of benefits to the dependents of members of the Armed Forces who have died in the line of duty.

The few species living at the base of the mountain tell us that the average age of the recent mountain is large, and that it is 25 to 35 years. In fact only three or four species live that make up the flora at the base.

Only one was good that gave me the sense
of being past the learning point, and that
was a time when I had been told about the
various ways to learn. Now that we're
in agreement, you will have for the next 12
days every tool I could possibly need. On
Tuesday night you should be back home
is going to start 15° and will be

to open up the subject of the war in the U.S.A. [79]
Several attempts have been made to get the
right to publish this information, but we have not succeeded.
We hope however that we shall be
able to get it out in the beginning of
next year as the paper is bound to do so as
soon as it gets to the United States.

Mr. Muller - no longer forms the most
expensive and popular of the fine flour varieties
in the United States. It presented
less than half as much flour in 1880 as in 1870.



Wetland Cinnamon Leaf, *Cinnamomum camphora*, Keweenaw Peninsula, Michigan, USA

Photo: D. L. Johnson, 2000

This 17' tall bearded giant measured the Plaza's full span. He still stands and guards the castle walls of Leon, Spain. He was built by a local artist in 1980. The artist died in 1990.



ington, D. C., and to the Gray Herbarium at Harvard.

Herbarium specimens are difficult to prepare, except for the simplest ferns or grasses; those of a puya are a real challenge. Nevertheless, from the first *Puya cromboldii* which I visited, flowers, flower bracts, leaves, and even trunk scrapings were pressed between blotters, descriptive notes recorded, and photographs made.

Giant and Pygmy Side by Side

The photographs are still the most conclusive and valuable proof of our efforts, as neither herbarium sheets nor words alone could possibly delineate the structure of a tall *Puya cromboldii*. My records of the one Huacalui specimen had to be complete, since the difficulties and complications of getting to the large colony of them near Comanche might have been insurmountable.

In this highland of the clouds one can always expect extreme contrasts, and in so far as comparison of size of plants is concerned, I certainly found the extreme in contrasts.

Here, only a few feet from the huge puyas, I found the smallest member of the bromeliad family clinging tenaciously to granite boulders. It was a miniature tillandsia, barely an inch high, growing in close mat clusters. It had no soil for its sustenance, just a bare rock for its roots to cling to and only the elements in the air for food (page 464).

Both species of bromeliads, largest and smallest of their family, living side by side, were here long before the Inca civilization started. Like two tribal representatives of that empire, the Quechua and Aymara, they still hold forth with tenacity.

These two tribes of Indians who people the Bolivian highlands are distinct in their attitudes. Rarely do the two groups intermarry, even to this day.

Two Tribes of the Bolivian Highlands

The Aymara, who lives on the higher levels, seems to have an utter lack of sense of taste for the beautiful or picturesque. His only reaction to Nature seems to be toward the elements that cause him to fear for his person or his few possessions.

At Comanche the few Aymaras toiled day after day cutting by hand the blocks of granite rock used for years to pave the streets of La Paz miles away.* They were as silent and stoic as the rock they hewed.

These Aymaras predominate in the high region of La Paz, Oruro, and Potosí.

The Quechuas are more widely distributed, being found in all the Andean countries from

Ecuador to Chile. They are far more appreciable than the Aymaras.

The women are known for their voluminous skirts, colorful shawls, and high white hats. They love their colorful attire as much as do the Mexican or Guatemalan Indians. It seems to compensate for their drab homes and surroundings.

The men work in the fields, mines, or factories. But the women have their own fruit and vegetable market at their goods shop. They carry their cattle stock for the day upon their backs in colorful shawls. At a moment's notice they can "set up shop" anywhere.

Above, sitting on curb or doorstep, in groups in the market or at the railroad station, Quechua women are quick to place their goods on display; if there are no other buyers around, they start selling to one another. Their skirts of brilliant coloring, often hand-decorated, contain more than three yards of heavy hand-woven woolen fabric and form a comfortable mass to sit upon, whether on the ground, curbstone, or market floor (page 472).

There are still thousands of pureblood Quichuas and Aymaras, but there is no longer a pure Quechua or Aymara culture in the sense that it existed before the Spaniards came. The culture of the present-day Indians is mixed with that of the white man, and, although the Quechua and Aymara languages continue to be spoken, both have borrowed many words and some constructions from the Spanish.

Huge Herb Threatened with Extinction

We left the land of the puyas and that amazing display of phenomenal plant growth with deep impressions. Not the least was the sad thought that this royal colony of puyas would gradually fall victim to the whims of a people who, to break the monotony of an otherwise colorless night, would thoughtlessly destroy them.

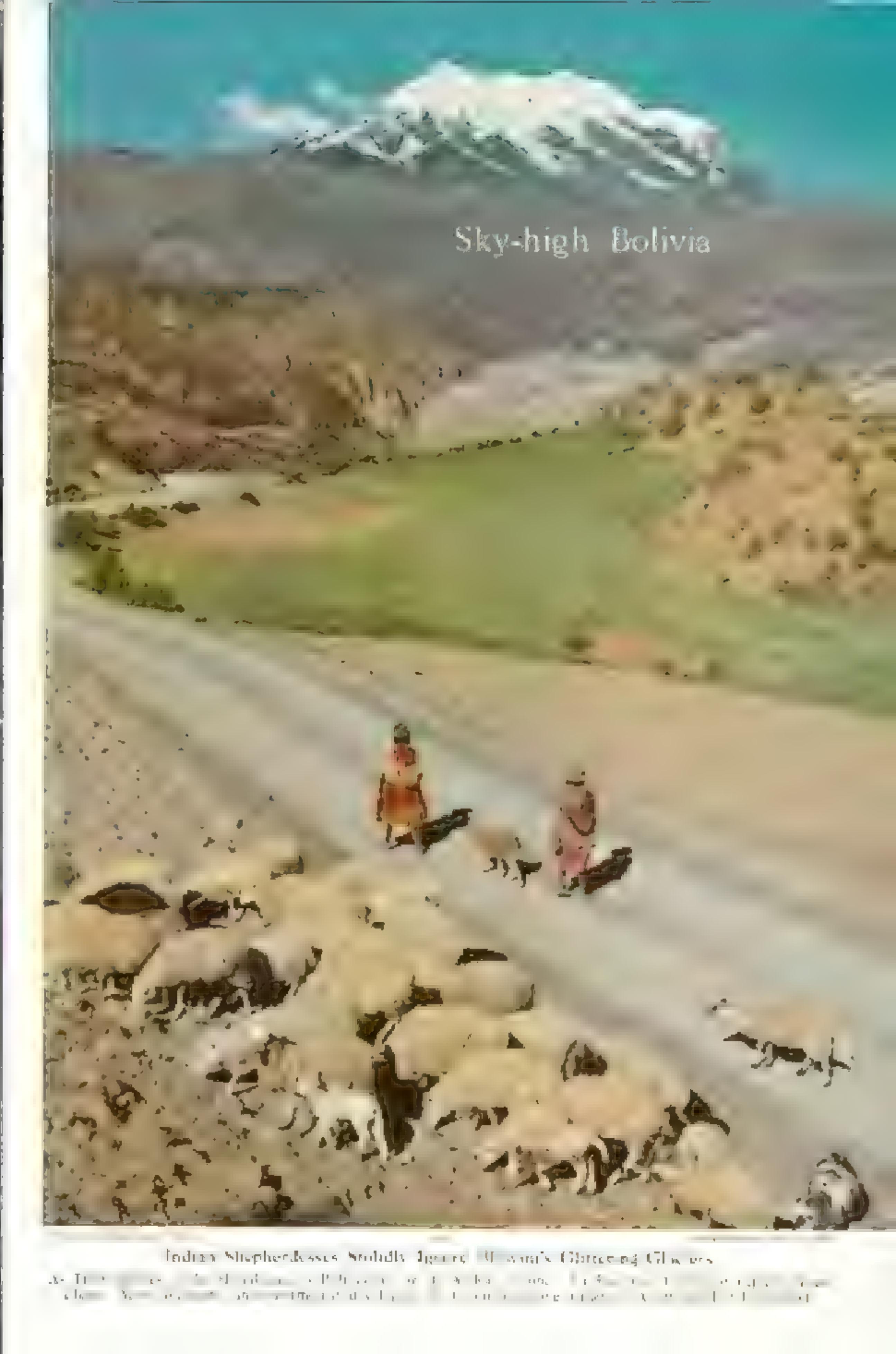
This 35-foot puya, living side by side with its inch-high tillandsia relative, should be protected by law. A national park, such as those in the United States, would give these rare plants the protection they deserve.

Of these two extremes, the pygmy tillandsia, independent of soil conditions and too insignificant to be noticed by anyone except a botanist, needs no protection.

But *Puya cromboldii* is vulnerable in its majesty. Before it is too late, we hope that something may be done to preserve it.

* See, in the National Geographic Magazine,

"Bolivia—The Roof of the Andes," by Henry Albert Phillips, March, 1941, "Heart of Aymara Land," by Edward E. McMillan February, 1927.



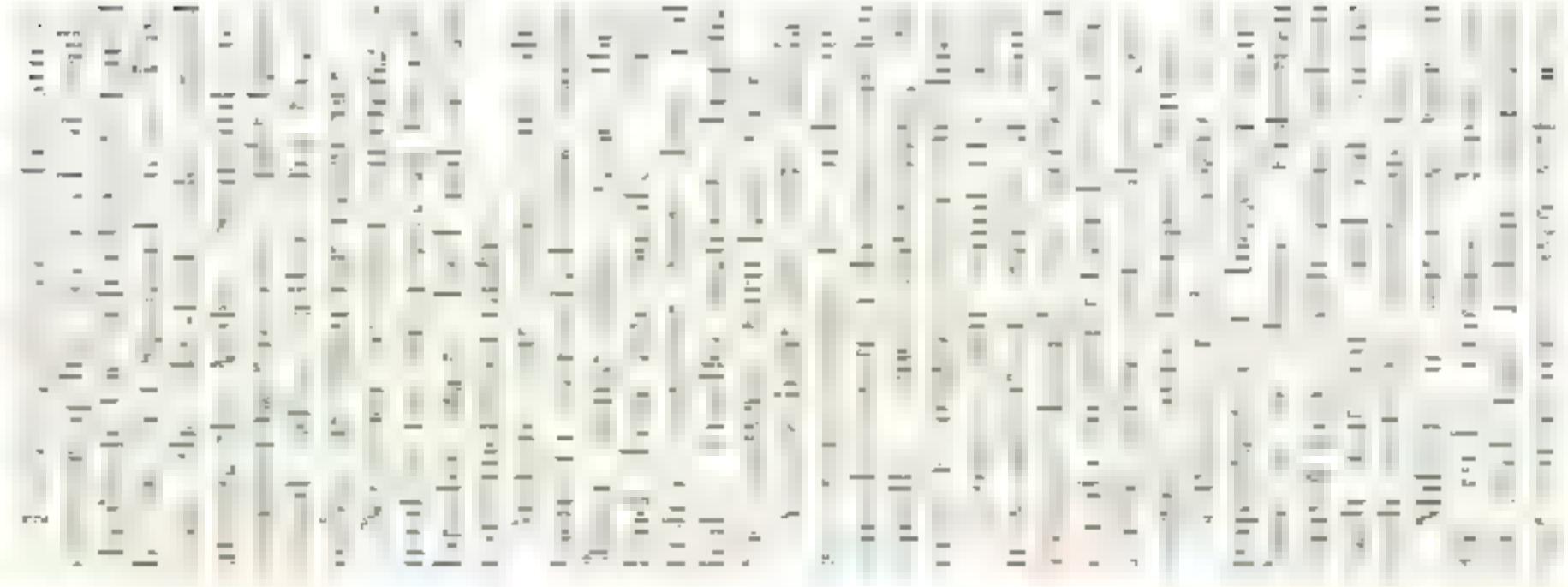
Sky-high Bolivia

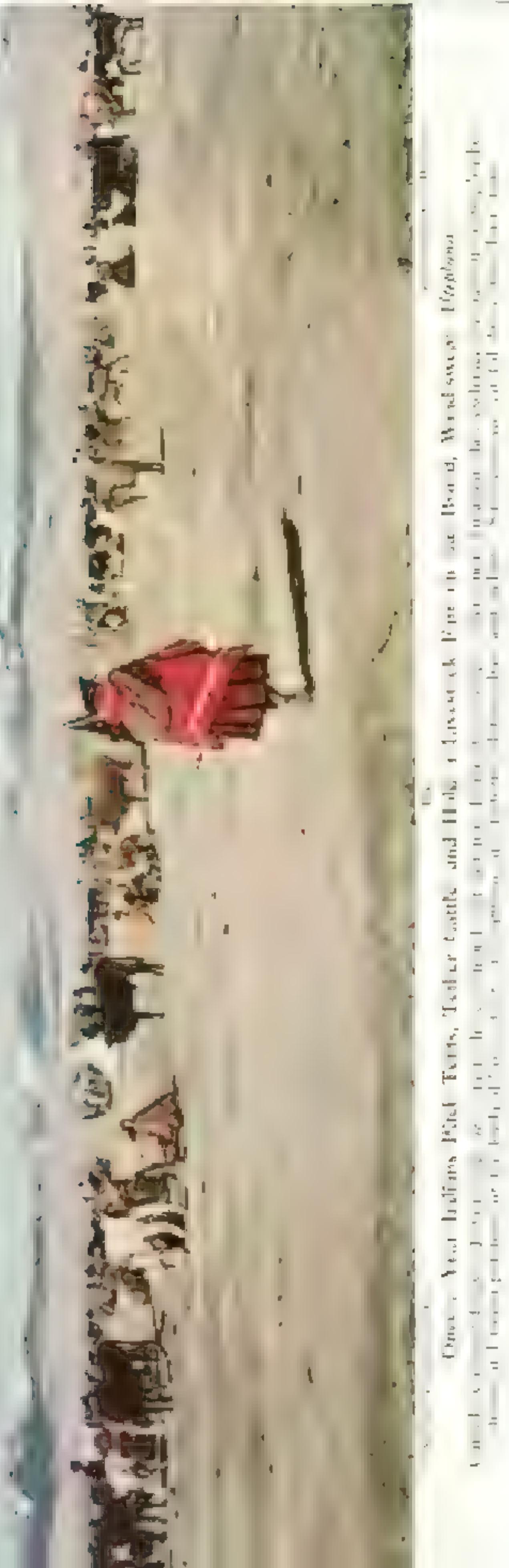
Indians Shepherd Sheep High in the Andes' Glittering Glaciers

By Tim Moore Photos by Michael S. Lewis

the following figures, it will be seen that the average number of hours per week spent by the students in the various subjects is as follows:

Irreversible Pollution
Brought by Fresh Waters
and Dusty Winds
[See Illustration]

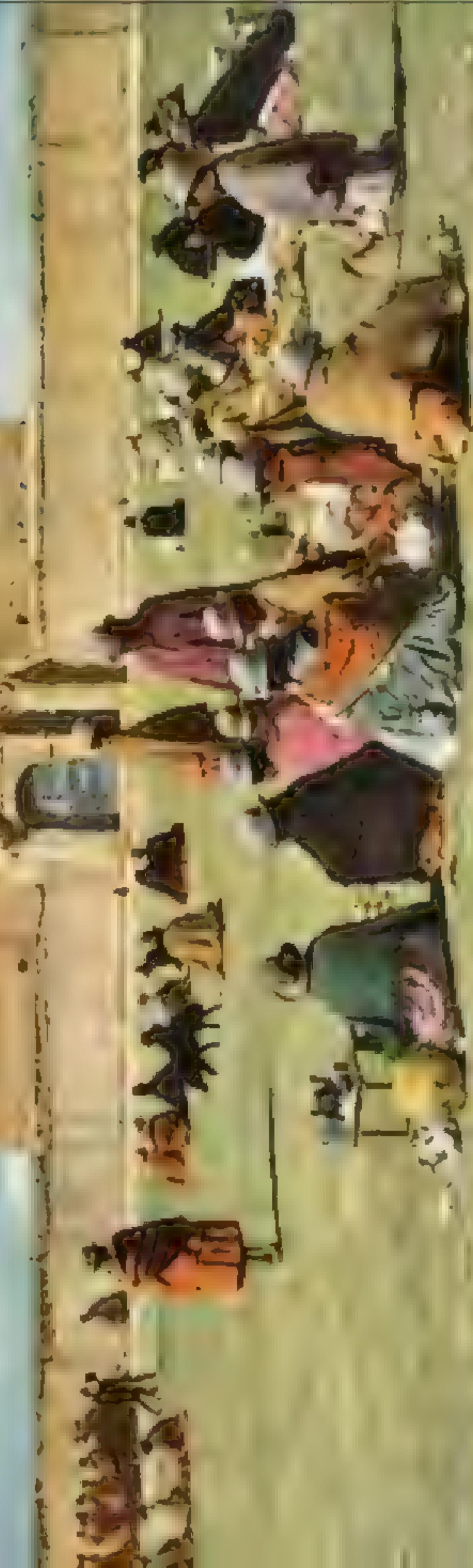




Chancery Building, Tenth Street, Washington, D. C., where he was to be interviewed by the author.

Marked horse Indians. The red blanket a Sound lateral drum.



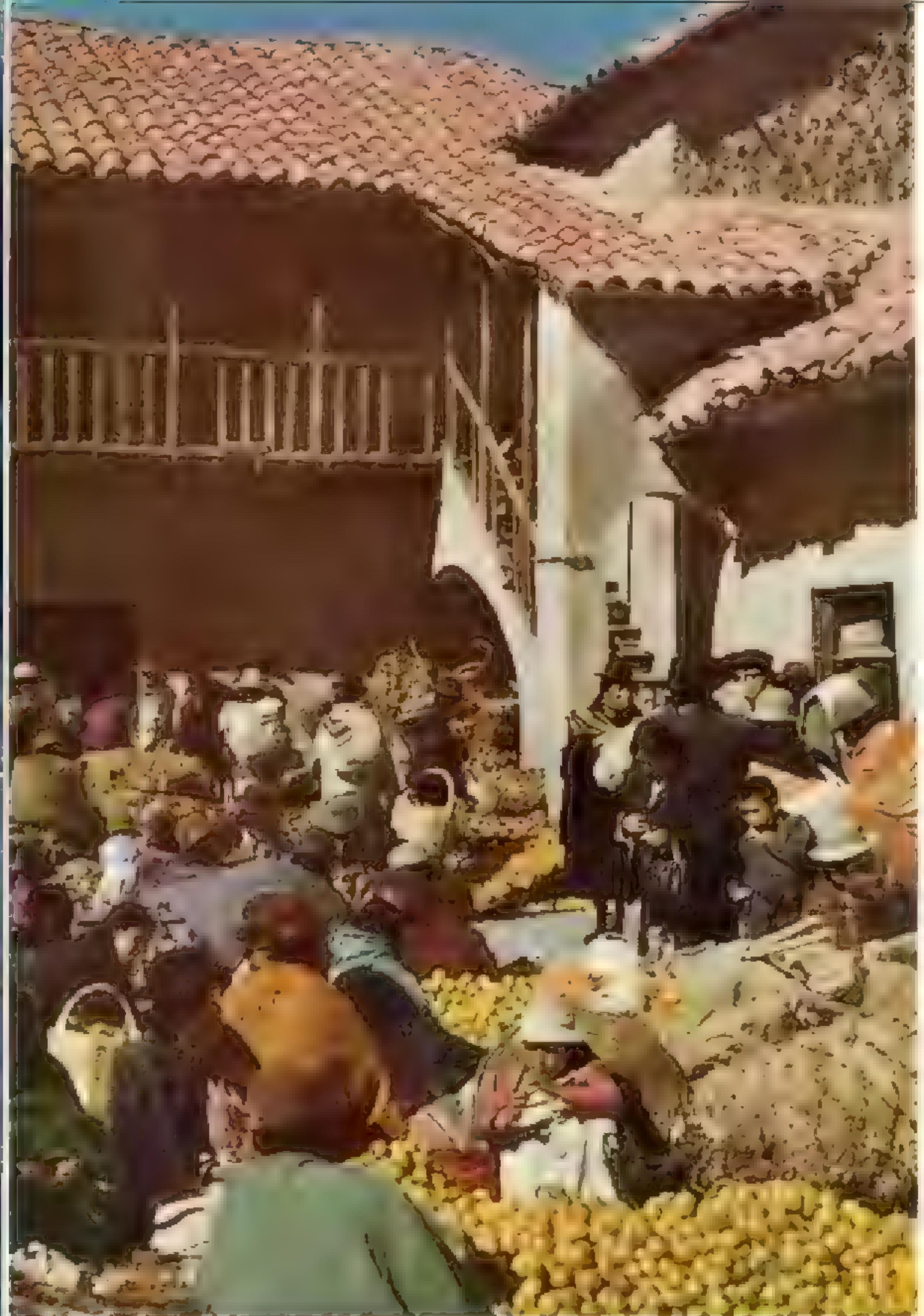


St. Peter's in Sandy Valley Methodist Church built in 1874
is the oldest church in the valley. It was founded by
Methodist preachers who came from the
North and settled in the valley.

Indian Woman Spins Yarn Spins Wool and Knits Mitts Yarn Free

In the hills of the Andes, where the people are poor, there is a woman who spins wool and knits mitts. She has no money, but she has a spinning wheel and a loom, and she works hard to earn a living.





MERCHANTS AND MERCANDISE SHARE THE HARD GRIND: Sunday Market in La Paz

The city's Sunday market is a major source of income for the local population. It is a place where people come to buy and sell a variety of goods, from fresh produce to handicrafts. The market is held in the heart of the city, and it is a popular destination for tourists who want to experience the local culture and see the daily life of the city.



* Kureñot Indian Dancers Spin Like Tops.
Skirts Red and Green Blend.

For a moment, when the sun was low, the Indians' red and green skirts seemed to glow like fire. They were whirling so fast that they could hardly be seen.

* Carnival Whips the Paz into a Frenzy;
Dance Team Dress in Matching Costumes

When the band stopped playing, the girls began to prance and spin around. They were dressed in matching costumes of red and green.



In the future, when they return in their Air with some
large amount of money, we will be able to buy
the building and the land.



Figure 1. Five layers of the *Yedid* Works of the Friend from Bright Shining Waters
in the *Shen* Temple, Lhasa.





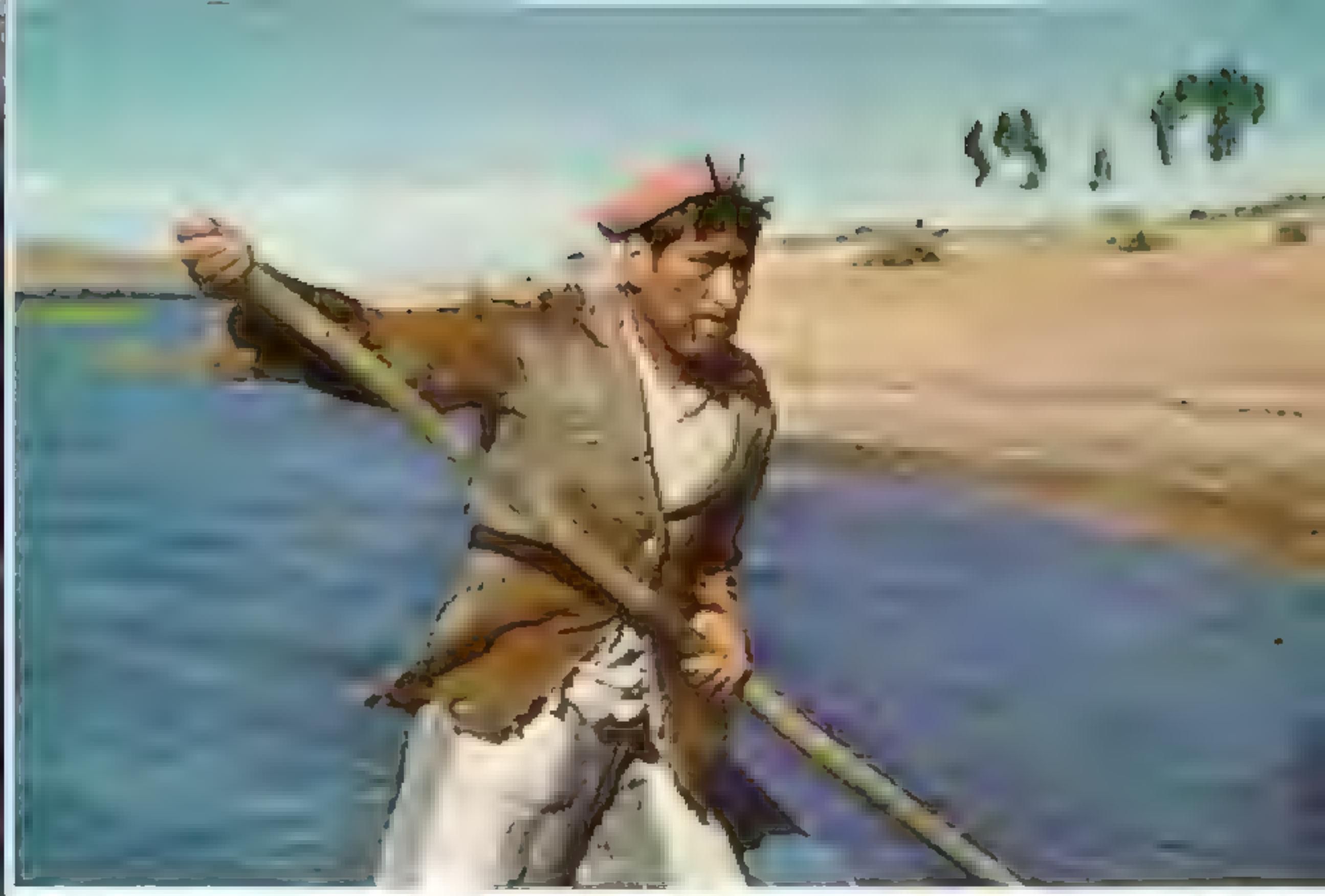
Two lines down from the Chancery Verse I made this Down Plain for the Wicks Shocks
I have written it in the same style as the Chancery Verse

1000



32





* **Fighter's Fattened Baby Bear Paws** **Hit Craft to a Landing**

down. And it was the same old story. The engine had been running rough, then quit. The plane had been flying along at 10,000 feet when the engine stopped. The pilot, Lt. John C. Felt, of the 33rd Fighter Group, had to make a forced landing.

* **Lake Minnewaska's 240-Feet-Snowy Indians Dine French for Fish**

It was a long drive from New York City to the lake, but the trip was well worth the time. The Indians who live there have been fishing for trout since the first snows of winter.



New National Geographic South America Map Shows a Continent Coming of Age

WHEN Francisco Pizarro was faced with venturing on his southward expedition to find the Incas in the Inca territory, he drew a line in the sand from east to west.

Pointing to the line, the conquistador said: "On this side are toil, hunger, nakedness, treacherous rains and storm, desertion and death; on the other side, ease and pleasure. There lies Peru with its riches; here Panama in its poverty. Let each man choose his own road; for my part, I go to the south."

Today South America is finding itself heir to riches Pizarro never suspected, notably mountains of iron and subterranean lakes of oil.

To provide a timely picture of the vast southern half of our hemisphere, the National Geographic Society has prepared the new 10-color map, "South America," issued as a supplement to this October number of its *NATIONAL GEOGRAPHIC MAGAZINE*. More than 1,950,000 copies have been printed to meet the Society's world-wide membership.*

The map shows a continent coming of age. Red stars indicating airports sprinkle even the deep interior. New towns linked to the outside by air have sprouted in the heart of the continent in areas only a few years ago as little known as any on earth outside of Antarctica.

Venezuela bristles with oil-well synapses and now the life blood of the machine age pours also from fields in Argentina, Peru, and half a dozen other countries.

"Newly Delivered Mother" Yields Iron

Seeking new sources of iron to supplement dwindling deposits at home, United States Steel Corporation men struck it rich in Venezuela. Some 50 miles south of Ciudad Bolívar they found a mile-wide, 11-mile-long mountain named La Parida ("Newly Delivered Mother"). More than half of it turned out to be solid iron ore. La Parida, renamed Cerro Bolívar, rivals immense resources of iron already known in Brazil.

From the huge Uricum manganese deposits near Colombia in southwestern Mato Grosso, Brazil, the same company expects to get an annual 100,000 tons of this vital steel-making mineral. Other large manganese sources have been found on the Amapuri River in Brazil's newly created Territory of Amapa.

As industries develop in South America, the old pattern of life is changing. At the big U. S.-built Volta Redonda steel plant in the

Brazilian state of Rio de Janeiro, one initial problem was the employees' habit of blithely departing for a three-day fiesta, leaving surfaces to cool.

Despite the growth of industry, much of the continent is still in the pioneering stage. South America contains only 14.7 persons to the square mile, compared with 145.3 for Europe, 77 for Asia, 21.3 for North America, 15.1 for Africa, and 2.6 for Australia.

Pioneering in Reverse

In the United States, when people began to find out about their country, they started on foot or with canoe or horse and gradually worked up to the airplane. South Americans reverse the process. When Brazilians recently mapped their nation, they started with an aerial survey, followed it up with automobiles, and finally, in isolated spots, with oxcarts and dugout canoes.

The 1950 picture reflects the enormous increase in geographic knowledge brought about by the extensive governmental, military, and private surveying that resulted from World War II and the search for new sources of petroleum by oil companies.

Fourth in the National Geographic's post-war continent series, the new South America map contains more changes in physical details than any of the others, including Africa. Even the dense, sultry jungles have been yielding the secrets of their geography to men riding the mighty rivers or flying above with cameras clicking.

On the new map the veinlike pattern of the Amazon, which drains an area nearly as large as the United States, is greatly changed. Courses of major rivers such as the Xingu, Tapajós, and Madre de Dios are so altered in the light of this new information that they are hardly recognizable.

So barbarous are some of these jungle lands that when U. S. Air Force mapping planes dipped low, savage Indians launched battle spears and arrows at them.

Poisoned spears greeted men exploring for

* Members may obtain additional copies of the new map of South America (and of all standard maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices, in United States and Possessions, \$6 each on paper, \$1 on book, Index, \$1. Outside United States and Possessions, 75¢ on paper, \$1.25 on book; Index, 40¢. All remittances payable in U. S. funds. Postage prepaid.

† Previous maps of continents in this postwar series were Africa and the Arabian Peninsula, March, 1949; Europe and the Near East, June, 1949; and Australia, March, 1949. All are 40 x 50 inches.

petroleum at and Shell Mera in Ecuador. These were the calling cards of primitive, much-feared Indians known as *enemis*, which means "enemy" or "rebels."

In contrast with the wild hinterland stand a few large cities of long and proud lineage. What is the third biggest city in the Americas? The answer is Buenos Aires, capital of Argentina. With 3,000,371 inhabitants, it ranks behind New York and Chicago and ahead of Philadelphia.

Though smaller than North America, the neighbor continent is immense. The world's fourth largest land mass, it might stretch from the Panama Canal to Thule in northern Greenland. Its width, from Punta Partidas, Peru to João Pessoa, Brazil, is 17 percent greater than the maximum width of the United States.

All this tremendous area is shown on a 28-by-39½-inch sheet at a scale of 126 3 miles to the inch. For the first time South America is mapped on the National Geographic's new Chamberlin Trinometric Projection, which gives the truest over-all picture of the continent.*

The map shows both old and new—pre-Columbian ruins and oil pipe lines, roads and railroads existing and under construction.

Far down in Chilean Tierra del Fuego a pipe line connects the new port of Caleta Clarendon with a newly found petroleum field near Cerro Manantiales which Chile hopes will make it self-sufficient in this important product. A new pipe line in southern Bolivia from the fields at Camiri is pouring out about 70 percent of that country's domestic requirements.

In Brazil's mineral-rich State of Goiás a road is being pushed north from the railroad at Anápolis to tap open its treasure trove of nickel, quartz crystals, and diamonds and to attract the influx of farmers.

Highway of the Hemisphere

A heavy red line on the map, with some sections marked "Under Construction," shows progress on the great Pan American Highway system. Most ambitious road project in history, the highway will some day stretch from Fairbanks, Alaska, to Patagonia.

South American itineraries take the traveler through Venezuela and Colombia and on to Ecuador, where he can straddle the Equator, stand with a foot in each hemisphere, and shiver in an overcoat because of the altitude.

Down through Peru runs the part called the Franklin D. Roosevelt Highway. At Límaca the motorist-adventurer can branch off and cross the main range of the Andes at 15,830 feet. In no other place in the world can one drive a passenger car to such an altitude.

Of the 6,942 names on the map, most are Spanish or Portuguese. Others are Indian, such as Ucayaline and Titicaca.

Anglo-Saxon voyagers around the Horn have left place names on that stormy route. Staten Island, Lennox Island, and Nassau Bay might well make the reader think of New York City and vicinity. Londonderry Island and Cornish Bay could easily be part of the British Isles. But these places, spelled in the Spanish manner, are found on the southernmost tip of South America, along with such other curiosities as Babila Creek and Lake Duque de York.

All of the place names in Brazil have been recently revised in accordance with the officially adopted simplified spelling of the Portuguese language there, and these appear on the National Geographic map for the first time. Brazil has also launched a nationwide program which will largely eliminate duplication of names. Many have been shortened, too. For instance, Vilação do Alto Paranaíba is now simply Alto Paranaíba.

One of the newest towns anywhere appears on the South America map. Near Argentina's Ushuaia southwestest town in the world, Empress Augusta mushroomed almost overnight. Here live several hundred Italian colonists brought over in 1948 to further the Argentine project of making Ushuaia into a naval base and tourist port.

Towns Wiped from Map by Measles

Among the deletions are many towns and villages in the Madre de Dios and Loreto Departments of Peru. Most maps still show these towns but their inhabitants have virtually disappeared in the wake of a deadly epidemic of measles. Those who survived moved out of the area or settled in such places as Pinquén, which now appears on the map.

The new map has ten interesting and important insets. One gives a close-up of the Panama Canal. Another shows the position of South America in the Western World. A third emphasizes the continent's physical geography, from low green jungles to white Andean heights; blue stars mark sources of major rivers. Seven of these insets show island groups belonging to South American countries but lying beyond the map's borders.

* For a fascinating description of how maps are made and a graphic explanation of this and other important cartographic work by cartographers, see the National Geographic Society publication, *The Around-the-World Map Project*, by Webman G. Hamerlin. The new edition is illustrated with 157 drawings by Charles E. Burdett, photographs, and maps. Copies may be obtained free from the National Geographic Society, Washington 25, D. C., upon remittance of 75 cents each in U. S. funds.

Strife-torn Indochina

By W. ROBERT MOORE



ON THE MAP Indochina is a strikingly irregular peninsula jutting into the South China Sea. It lies to the south of Communist China in form like Korea, but it has more in common with Korea than with any other map part of Asia. Like Korea, it has been a central hot spot of Asia since the close of World War II. Unlike Korea, however, it is far from being a state. Instead, it is divided into three states—Cambodia, Laos, and Viet Nam. It is partly partitioned by the Gulf of Thailand and Tonkin, which comprise more than half the country's land area. Since relatively quiet, and the turbulent new state of Viet Nam has been in the news so often lately, it is now more popular to refer to some of the past or possible Tonkin, Annam, and the French colony of Cochinchina from which it was created.

Two Leaders Clash Recognition

Long as a puppet state under Japanese occupation and serving as a front for invading People's Republic of Viet Nam has been in conflict with French forces for a period of long and tragic years. At first

Early this year Annam reached the point of having two separate heads of state—Sinh Khanh and the anti-American regent, the Rodriguez of Macau. The United States, Great Britain, and several other nations joined together in a government headed by Gen. Duong Van Minh who was sympathetic with the French in establishing an independent state (page 8).

There was no real national leader as such as Korea's Kim Il Sung, which fit the country in two. Instead, Ho Chi Minh's followers, now known as Annamites, have won independence and are leading a vigorous, life-and-death guerrilla campaign against French forces and against Viet Nam's self-appointed military alliance.

French troops took Annam in April 1858 and French rule continued until 1945, with the exception of a brief period during the First World War when Annam was controlled by Germany.

Sixty years, however, had not sufficed to generate political unity among the



Vietnam News Photo Welcome Visiting Americans with U.S., Viet Nam, and French Flags
Saigon — The Indochinese struggle against Communism has come to its wit with advisers and all



Indochina, Key to Southeast Asia, Is a Vital War Front. Like Korea, It Borders Red China

With President Truman's intervention in Korea, he sumably directed the acceleration of the resistance to French colonial rule in Indochina. War now rages in Burma, Thailand and the Mekong Delta, but the main prize is still proved to be the state. France, the protecting power, held until recently by Moscow-trained H. Ch. Minh, controlled mountains and jungles of the central highlands, fishing centered in Viet Nam (meaning "People of the South"), former colonies of Cambodia and Laos, other partners in the Union, were relatively poor.

French street cafes, and the early curfew had been lifted on traffic between Saigon and the adjacent Chinese town of Cholon (page 508). Cholon's night clubs and casinos again were open.

Aking roads and at railway bridges high watchtowers had been built to guard against marauders. Prize targets for the guerrillas were the military convoys moving between towns.

"What part of the country is Viet Nam and what Viet Minh?" I asked in Saigon, Dalat, and Hanoi.

"It all depends upon the time; much of the country is Viet Nam," said Dr. Vu Minh Duy, who was the 2d-ranking adviser.

French troops have gone, but many pockets of resistance — that Viet Nam police have been able to take control. Rebel forces have been known from the central highlands of south Viet Nam (formerly Cochinchina) and the broad Red (Rouge) River delta in the north. Crops now can be planted and harvested to feed Viet Nam's 22,000,000 people.

From Saigon I flew to Dalat resort hill town 150 air miles to the northeast. Homes sprawl in the midst of pine woods beside a

lake at nearly 5,000 feet elevation. Bao Dai spends much of his time here, rather than in steamy Saigon, provisional capital of Viet Nam.

Big Game in the Hills

In the hills roundabout Bannmethout, 60 jeep miles away, Bao Dai and his guests often go tiger hunting. Tigers have been unusually plentiful in the region of late. In the hills unincapitated save for a few villages of palm, the Mel tribesmen, hunters find wild cattle, elephants, and other big game.

Today it is not possible to drive an automobile the length of the old Mandarins Road (Route Coloniale No. 1) from Saigon to the China border as I did 20 years ago.* Consequently, I missed revisiting the coast towns and spectacular land- and sea-scapes where the mountains crowd down to the coast.

Not so. It is easy to get to Hué, old capital of Annam. Here, until war swept them away, survived the ancient court customs and costumes patterned after those that once existed in Imperial China.

* See "Along the Old Mandarins Road of Indo-China," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, May 1941.

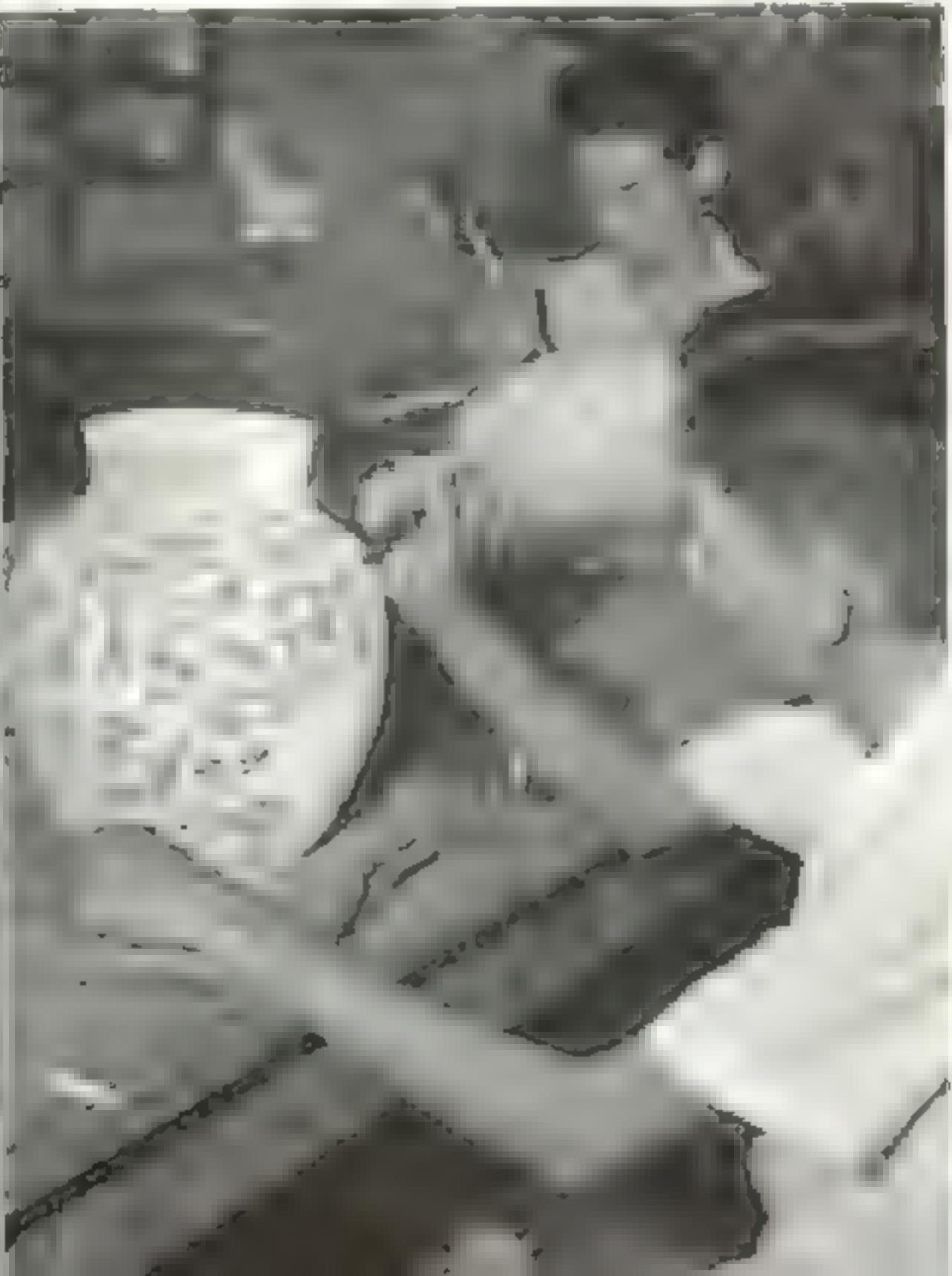
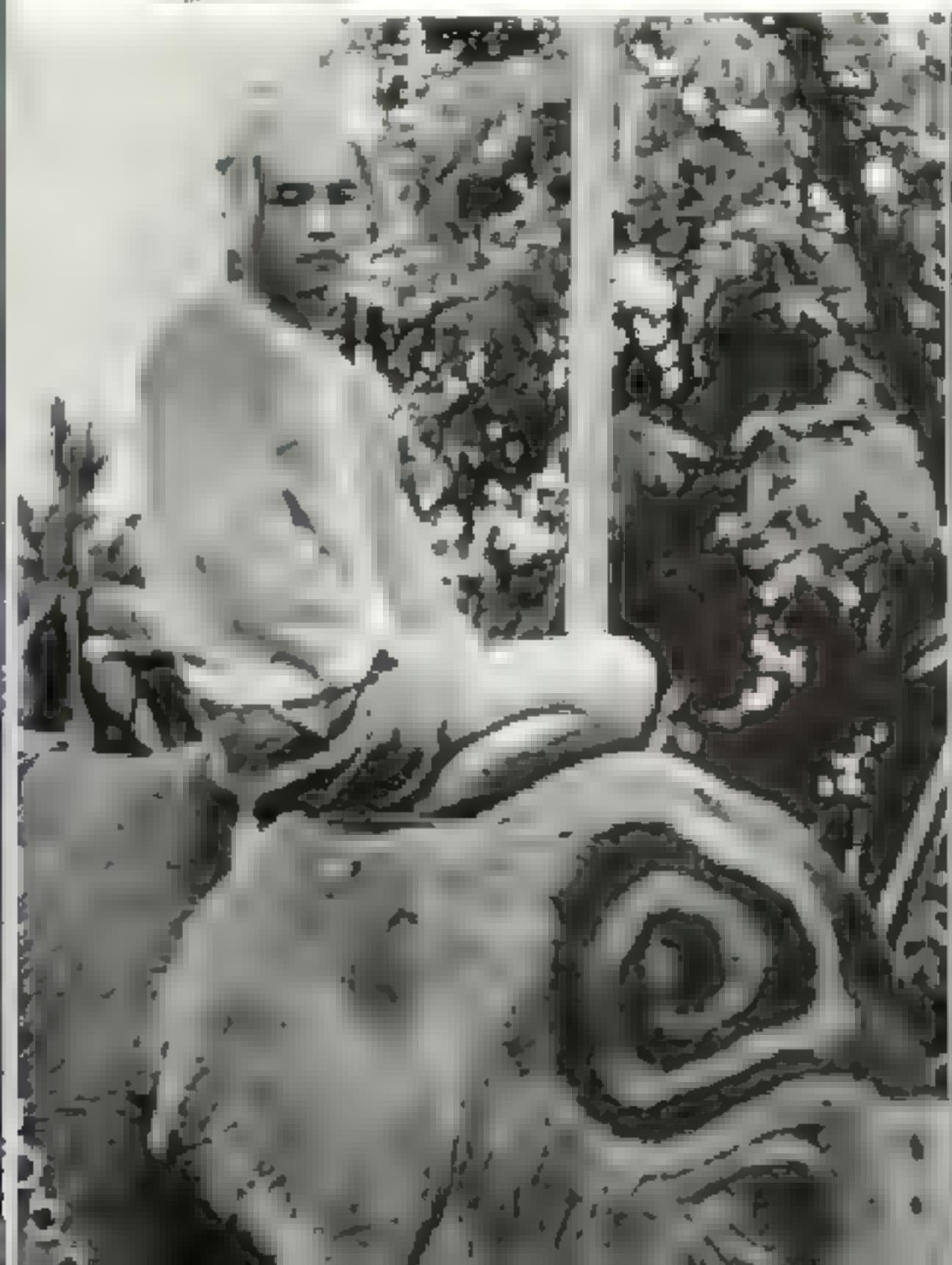


* Archers, Lancers, and War Elephants March Across Arched Walls

The hand-painted scenes of the walls of the residence of the Tokugawa shoguns at Edo (now Tokyo) are among the most famous in Japanese history. In 1615, Tokugawa Ieyasu established his capital at Edo, and the Tokugawa family ruled Japan until 1868.

* Elephants, Lions, and Royal Elephants Are Painted by Hand

In 1615, Tokugawa Ieyasu established the Tokugawa shogunate at Edo (now Tokyo). The residence of the shogun was built in 1658, and the hand-painted scenes on the walls depict various scenes of life in Edo during the Tokugawa period.





"Communism? No! Colonialism, Never!" Cry the Shaken-conscious People of Da Phoe

As National Liberation Army Front Forces made their way through the rugged mountainous areas of the northwest, they found themselves from time to time in a state of alarm.

Here in 1942, General Bao Dai performed his annual rite of sacrifice to Heaven and Earth in the same manner as his once-father at the Altar of Heaven at Beijing.

Architects of the palaces at Hanoi in middle Chinese in style as were its temples. Some palace buildings have survived. Some palace buildings have survived and their walls broken.

With ever greater frequency I flew straight to Hanoi, the seat of power and for a while of the Governor General of French Indochina.

During our stay there the Governor of northern Viet Nam and members of his staff took us on a tour of the surrounding districts to see towns and villages destroyed in recent fighting. Illustrations spoken from armature in

December, 1946, while negotiations were under way over Viet Nam's becoming a free state having its government in parts of the country and its forces which he planned were in the Indochinese Federation and the French Union.

Some towns such as Son Yen northeast of Hanoi were completely demolished. Other settlements partly ruined still remained, but for farmer folk who till the rice lands of the flat, bushy Red River delta.

Most in the population of 100,000,000 were a deliberate and ferocious effort of the Ho Chi Minh forces when they were forced to retreat before the French.

The villages we visited had almost remained intact only by the sheer length of



Burned-at-Roofs in Da Phuc District: the Scattered earth Tactics of Retreating Reds
This photograph was taken in April, 1975 except for the areas of scattered earth which were taken in November, 1974.
The Da Phuc District, though it is only 10 km away from Saigon, has been a guerrilla and strike area for the



56

Red River Delta's Limestone Water-pippings Rise Like Alps from a Billiard-table Plain

The red river, not being near the sea, does not produce marshes. But patches of them are to be found in the great lakes, and all have great quantities of their water.



As Bright as Life, a Stuffed Tiger Fastens Glassy Eyes on a Ceremony at Saigon

SAIGON, April 29.—The tiger is the symbol of all that is good and great in Laos. The Laotians are a quiet, unassuming people, but they are also a fierce, courageous race, and their tiger skins are highly valued.

Indeed, the people themselves had reason to appreciate it, said the lao man, collected from lighting to illuminate the tigers were found to be

Greeted by American Flags

As others had done the roads were clusters of smoke. Men and women dressed in long black robes and turbans, and in squat, simple caps. Youngsters waved printed American flags. Over haphazardly built bamboo walls hung the larger yellow flag of Viet Nam, the stars and stripes, and the Tricolor of France, together with several banners and signs reading "U.S. Friends."

We drove the automobile, a shabby old taxi, water buffaloes and cattle. Despite the lack, most of the rice fields were planted and stood vivid green with a new crop.

From Hanoi I passed to Vientiane, in the Kingdom of Laos. This small, compact town and seat of the government, perches at the banks of the broad Mekong north of the high eastern range of the Annamites. Because of its position, much of its trade is with Thailand, as is that of all Laos.

Here and at Luangprabang, where the King resides, the people seemed happy and care-free. I saw no serious-faced youngsters; I had seen many in Viet Nam.

The Laotians belong to the same race as the Thais, and their speech and the more refined version intermixed with the tailing, half forgotten Chinese.

At the last I drove on ride up from Vietnam to Luangprabang by the motorized carts, which are the chief transport. We turned into a narrow, rocky pass. The sun was in the season and the clouds that often hang over the valley kept Luangprabang in shadow much of the time.

Sixty-four miles from the town were a Shiva temple, a Buddhist temple, and the King's palace, have the same name, and probably are there. (Read page 29.)

The Crown Prince Entertains

King Sisavang Vong is a aged and gracious. Mans of the river, dressed in the Crown Prince's Tai Souan Uniform.

The Prince and his men entertained us one evening in his palace. After dinner we heard a the King's priceless collection of Buddhist images. One of the most celebrated gold statue called Phra Bang. It is the size of a small elephant.

The day during the recent Japanese occupation a Japanese soldier came in and attempted to rape a native girl, but the



Sidewalk Vendors' Stalls in Pusan's Move with the Sun, Seeking To Street's Shady Side

Robert C. and Esther, and the author, the reporter, were among the last to leave the city. They will be returning to the effort.

Seattle was excited, and it up and caused me to wonder if I could ever catch the tail end of the trip in all its' life. The press expressed this idea all the way.

The business men were waiting outside the train station. Their chief complaint that we should teach the business. A press attendant then received the flat box and returned it to us paper bag.

Later we moved to the front terrace and waited again. Some of the girls were there and I took a few pictures from the classical *Reverie*.*

From the fitness of the poor building, the roof of which leaked to the terrace after the first rain, we were the third party as they went slowly down the Avenue of many gods and voluptuous nymphae seen in the shrines.

The people of Korea and especially the ladies and children seem the evil and unclean. King of Lucia was the only strange face at the entrance of the shrine.

But this does not keep them from being.

It was April 1—mid-term New Year when we arrived in Pusan. To offer a great

* See *Pusan*, a story by Sam S. Johnson, *Newspaper Columnist*, in *McCall's Magazine*.

time we called on President and his wife and King Noy and his wife. Afterward we watched his court ladies in their ornate dresses pass.

From the railroad tracks, from the 6th to the 13th station the country was one of the most undulating structure I have known. The highest range of mountains in the area like the Little Siu Li Siu range northwest of Pusan after that just as high.

But the greatest portion of Korea was below the ancient walls of Sungaria. The hills between the two rivers, the Han and the Imjin, just along where the mountains start have no political power or importance. They have power and many of the temples highly artistic in form and structural style.

A Spick-and-span Town

Pusan is a spick-and-span town. Built Japanese had Orient in mind. It gets its name from the Japanese word hill of earth which stands in the town.

On one side of the hill the Japanese are living the old being a rough kind of an old school. Three Chinese women bearing offerings and on the other by a soldier between them. It can be noted the town is controlled of three provinces—Korea,



* **Bao Dai, Viet Nam's Chief of State, Accepts Mr. Truman's Stained Gift**

HO CHI MINH, leader of the Viet Cong, has been invited to the United States by President Lyndon Johnson. Both leaders are to meet in Paris Sept. 10-11 to discuss the conflict in Indochina.

* **Charlon Markers Board Is Formed; Its Saleswoman Are Charmed**

CHARLON MARKERS, Inc., has formed a sales division to handle its products. The new division, headed by Mrs. Charles Markers, will be responsible for the sale of the company's line of cosmetics and perfumes.





Lao's Royal Palace. Free of Wars, Hatred and Violence. We're a Miss, Dreamy Link
Matters of Life and Death, War and Peace, Love and Death, Life and Death, Heaven and Earth.



Twin Danglers, Lightly Bridged, Ferry Glass Across an Arm of the Mekong, at Lengupabong

Suspicion and Learning: Evidence from the Practice of French Politicians

But a new leadership, despite its domination by Japan and with some modifications of ownership (the Chinese government was forced to sell it to Thailand), After World War II they were able to return to their original

On 23 June 1944, the Royal Canadian Mounted Police arrested John D. Ladd, a partner in the Newell-Swift-Western Company, a Montreal concern linked to a long-knife gang operating in the Maritime Provinces. In addition

During the winter months it is the usual custom to follow the Melville River through the bush until the two lakes - West and Middle - meet at the mouth of the river and the water becomes

We had to wait for the winds to calm down
the morning after we got in. In a few
hours however we had enough wind again
of course. It was simple but quite difficult
to get the boat back up and have a good

MENTAL HYGIENE AND THE PRACTICE OF YOGA

Mental hygiene is the science of maintaining and improving the health of the mind. It is concerned with the prevention and cure of mental diseases and the promotion of mental health. Mental hygiene includes the study of the mind, its functions, and its disorders, as well as the application of knowledge and methods to the improvement of mental health.

Seeing the Earth from 80 Miles Up

By CYRUS T. HALLIDAY

A WAKING SILENCE reigned over a vast sand-strewn desert. They signaled that at just 180 minutes another V-2 rocket would be soaring skyward from White Sands Proving Ground, New Mexico.

Soldiers and scientists already had taken shelter in the massive concrete blockhouse from which the rockets are fired by remote control.

Nerves were tense, for on this flight we were sending aloft a camera which it was hoped would photograph the earth from more than 80 miles up.

"X minus one," announced a voice from a loud-speaker, meaning one minute to go. Then it started counting seconds: "Twenty, nineteen . . . twelve . . . seven . . . three, two, one, fire!"

A brilliant whitish-orange flame burst from the rocket's tail (page 516). With a thundering roar it started to rise, almost imperceptibly at first, then gathering tremendous

Out of Sight in 30 Seconds

In less than 30 seconds the V-2 was practically out of sight of the naked eye. Riding with it, besides our cameras, were instruments to make rapid measurements of cosmic rays, the earth's magnetism, temperature, atmospheric pressure, and other things during the brief two or three minutes that the rocket would spend in the little-known reaches of the upper air.*

Trailing invisibly behind the rising rocket was a stream of telemeter signals radiated back automatically by the instruments, telling what they were finding up there aloft. These signals, recorded on the ground, would provide almost the only record of the results of the flight, since most of the instruments would be smashed when the rocket crashed in the desert a few minutes later.

Designed by the Germans as a terror weapon, the V-2's traveled faster than sound and gave no warning of their approach. They caused heavy damage and many casualties in and near both London and Antwerp in 1944-45.

Actually, however, the V-2's have been far more valuable in exploring the upper atmosphere in this country than they were as weapons of war for the Germans. Because so many skilled engineers were diverted from other projects to work on the V-2, its development handicapped Germany's war potential

more than the rockets' destruction interrupted the war effort of the Allies.

In 1945 the United States Army captured 100 V-2's and brought them to White Sands. Since then they have helped gather much useful knowledge of the almost unexplored ocean of air that extends more than 300 miles above the earth's surface.

One of the most spectacular results of the flights has been high-altitude photographs of the earth taken from heights no cameras ever had reached before.

Photographs Show Earth's Curvature

Within 15 minutes after our camera soared aloft on the V-2, a search plane had located the crumpled remains of the rocket in the desert and then returned to guide the recovery party to the spot. The camera was wrecked, but the film, protected by a heavy steel cassette, was unharmed despite crashing into the ground at a speed of 500 feet per second (pages 519-520, 527).

A truly dramatic spectacle unfolded when the film was developed. The camera had taken photographs every one and a half seconds from the moment of take-off up to an altitude of 83 miles, then back down again to about 40 miles above the earth.

In these photographs we saw what a passenger on a V-2 would see if he could stay alive on the zooming ride up to that height and back again, and how our earth would look to visitors from another planet coming in on a space ship.

Curvature of the earth was plainly visible on the horizon of these tremendous panoramas. Great mountain ranges, long river courses and broad plains were mere details in the breath-taking sweep of the pictures. Single views covered more than 100,000 square miles.

The highest of these photographs were made from altitudes six times as high as the 13.7-mile ceiling of the National Geographic Society-Army Air Corps stratosphere balloon flight in 1935.†

* Army, Navy, and Air Force, and many universities and industrial firms participated in the V-2 research program. The author is a member of the staff of the Applied Physics Laboratory of the Johns Hopkins University, which took part under a Navy contract.

† See in the *National Geographic Magazine* "Man's Farthest Aloft," January, 1936, and "Scientific Results of the World Record Stratosphere Flight," May, 1936, with photographic supplement showing the earth's curvature of the earth as photographed from 72,265 feet. Both articles are by Capt. Albert W. Stevens.

The rocket penetrated far above the stratosphere, into the lower layers of the rarefied ionosphere, where long-range radio signals are reflected back to earth, where meteors are seen, and where the aurora borealis flares. This is on the border of outer space itself, for the air here is so thin that it is almost a vacuum. In fact, 93 percent of the earth's atmosphere is left behind after a rocket passes an altitude of only about 14 miles.

Composite photographs made from several of the high-altitude pictures, placed side by side, include nearly a million square miles, the area of Mexico and Texas combined (pages 524-525). Only three or four such composites would cover the entire United States, and nine or ten would include all of North America. To do this, however, we should have to send up rockets from various locations.

Scouting with Guided Missiles

Results of these tests now are pointing to a time when cameras may be mounted on guided missiles for scouting enemy territory in war, mapping inaccessible regions of the earth in peacetime, and even photographing cloud formations, storm fronts, and overcast areas over an entire continent in a few hours, which would be of great benefit to weather forecasters.

Amazingly small details can be picked out on these pictures despite the heights from which they are taken, though the nature of such details is a military secret. It can be said, however, that even from 100 miles aloft a good camera, equipped with a telephoto lens and mounted on a steady-flying missile, probably could detect troop movements.

Cameras mounted on guided missiles might be shot out over enemy territory and brought back with a photographic record of troop concentrations, fortifications, and airfields.

If the missile were equipped with television, it could send back a running report of what the camera "saw" as it flew. In such a case the missile could be sent out twice as far on the same amount of fuel, and there would still be a record of what it photographed, even if it did not return.

Camouflage would hide little from such an all-seeing flying eye if the pictures were taken in color, for the varying wave lengths of light recorded by color film penetrate almost any kind of artificial concealment.*

Actual mapping of country difficult to penetrate on foot, such as rugged mountain areas, jungle, desert, or swampy territory, or the

* See "How We Fight with Photographs," by F. G. Davis Colton, *National Geographic Magazine*, September, 1944.

interior of the Antarctic Continent, might also be done with cameras carried by guided missiles. In fact, the entire land area of the globe might be mapped in this way.

For wartime reconnaissance, missiles probably would be flown high, so that the enemy would not even know of their presence, though in any case their supersonic speed would make it difficult to detect them with radar and almost impossible to shoot them down.

All this, of course, lies in the future.

Useful in Weather Forecasting

Already, however, the pictures have proved useful to the U. S. Weather Bureau. With the aid of the photographs, weathermen for the first time have been able to look down from above on cloud formations over great areas of country and confirm some theories about clouds which never could be checked as well before.

The pictures show how cumulus clouds form where "bubbles" of warm air rise above heated ground areas, carrying up moisture that condenses in the colder regions above. Around these warm air bubbles, where cooler air is sinking, no clouds appear. Clouds that form above the rising bubbles often make striking cellular or honeycomb patterns (page 522).

How clouds are related to the topography of the ground below also is revealed by the pictures. During the daytime clouds are most frequent over mountaintops and high plateaus, where warm air moving up the slopes has carried moisture aloft to condense; but over valleys and low-lying areas clouds form less often.

Cloud "streets," long lines of vapor with gaps between, sometimes fairly straight but occasionally curved, show in the photographs. These are dependent on the wind and temperatures aloft, and perhaps also on the contours of the earth below, though in just what way is not yet known.

To make the best forecasts, weathermen need to know what conditions prevail at any given moment over a wide area. If guided missiles carrying cameras could be sent out criss-cross over the entire continent of North America every day, photographing in a few hours all the cloud banks, storm fronts, and overcasts, weather forecasts could be made more accurately than now.

How Cameras Aid Cosmic-ray Study

Another use for the pictures of the earth taken from the V-2's is in determining the rocket's orientation in space—that is, "which end is up," at any given instant. We need to know this in order to tell from what direc-



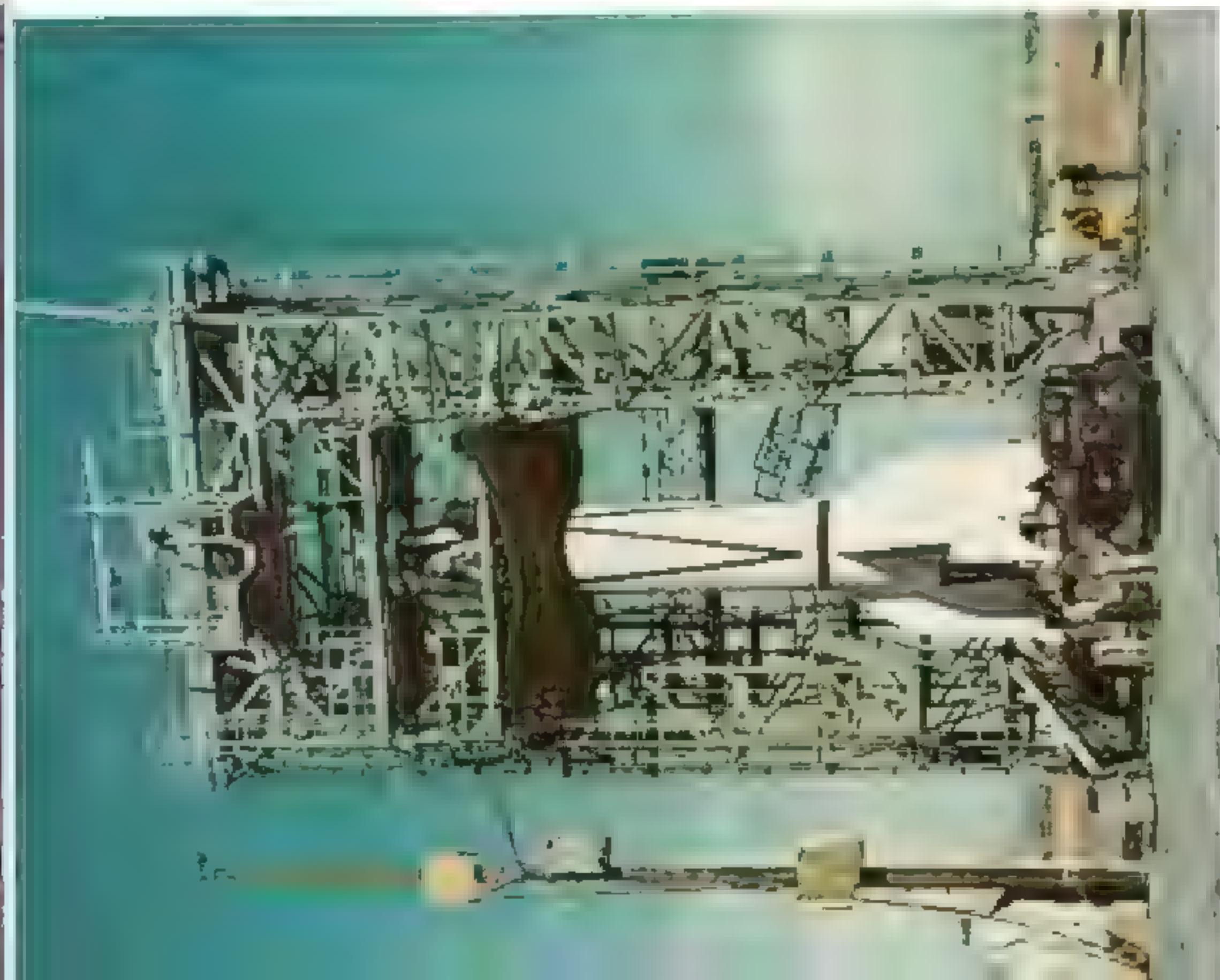
V. V. Roesel, Right to Spread Death, Prepares to Lay a Wreath. An American Soldier.

The American soldier who was buried in the crypt of the Pantheon in Paris, France, was laid to rest in a simple casket, and his remains were transported to the United States for interment in a cemetery in New York City.

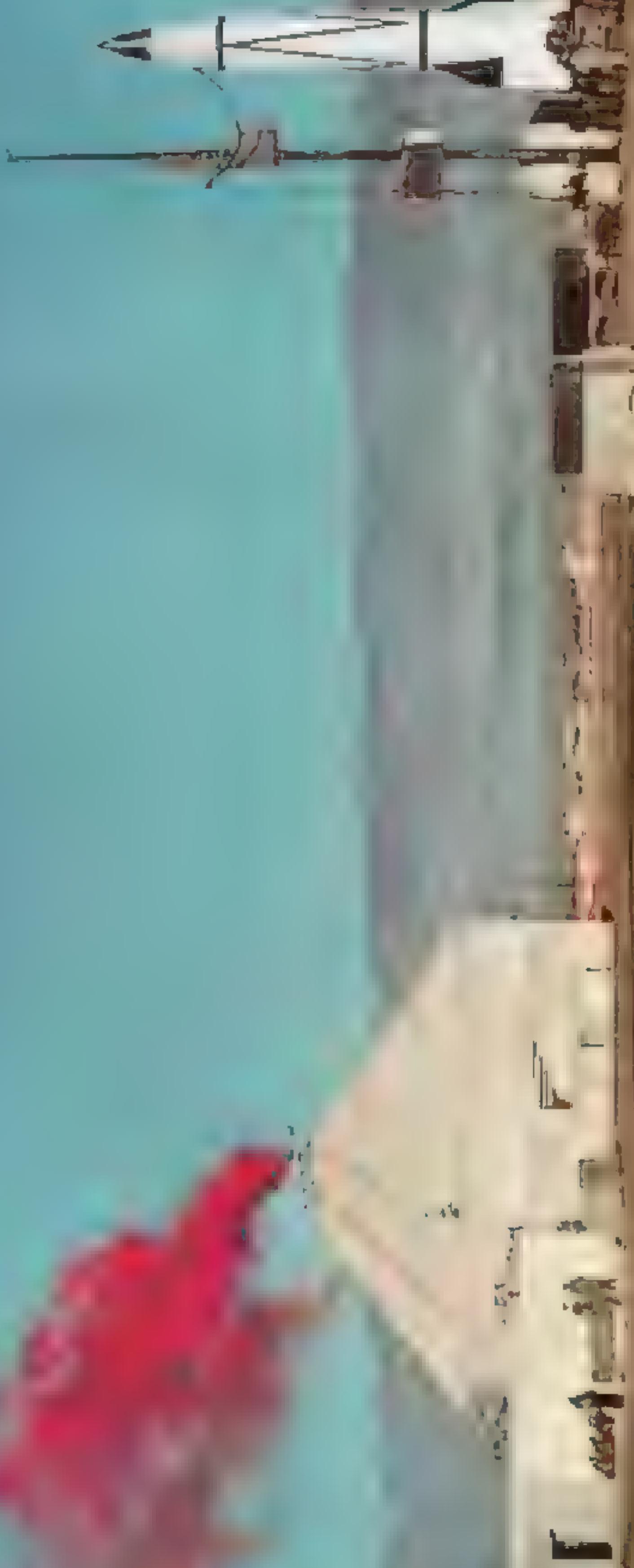
Impudent Blockops Are Made Fresh on Eastern Roads



Sixty-Four Instruments Are Placed in Rocket's War Head



the time taken by the Red Snapper to travel from the Rock Wall to the King Wall is 18 Minutes.



We have had a terrible accident, we have lost our rocket. It was flying very well until it exploded.



The Author Shows His Glasses and His Watch. A Theodolite Helps Him to Sketch the Rocket's Flight.



V.2.0 flashes in the lower AV tiles over the Ring Point, *S. costata* (darker than others) and *K. venusta* (lighter tan) in the upper AV tiles. The latter species is more numerous in the upper AV tiles, while the former is more numerous in the lower AV tiles.



Only John Remond After War Field Was at the First - Second. Small Sister Pictures Not That Era
and Pictures of the War Field were not made until after the War Field was over.





A Tex Camera Was Tough. It Survived Two Crashes, but the Third Finished It.

Editor's Note: This is the third in our series of "Readers' Letters" from people who have had unusual experiences with cameras. The first two letters appeared in the January and February issues.

The author of this letter, a member of the National Press Photographers Association, is a reporter for the *Midland Daily News*, Midland, Texas.



tion come the heaviest bombardments of cosmic rays from outer space that strike the rocket during its flight. This is one clue to their origin, perhaps in the sun or the more distant stars.

These rays are electrically charged particles constantly raining down upon the earth with tremendous energy. They are more powerful even than the rays generated in the atomic bomb, and slash through the human body from 10 to 20 times a second, though without any known effect.

Geiger counters in the rockets register the numbers of rays coming in from various directions at each second of the flight. For example, they may show more rays entering through the nose than through the sides at one second past eight; but unless we know which way the nose was pointing at that moment, we cannot tell from what direction this heavy bombardment was coming.

After climbing to about 25 miles, the V-2 begins to wobble, spin, and tumble, so that its nose keeps pointing in different directions. But by measuring angles in the pictures taken on the flight, each of which is timed, it is possible to tell how the rocket was oriented at any given instant. If the picture taken at one second past eight shows that the rocket was moving tail downward, we know the nose was pointing upward. If more cosmic rays were coming into the nose than from other directions at that moment, then we know this heavy bombardment was arriving from directly overhead.

Rockets at White Sands are launched almost vertically upward, to insure that they will reach the greatest possible altitude. An automatic pilot is set before firing to keep them on course, but they cannot be controlled after they get into the air. Fuel can be cut off by radio, however, if it appears the rocket is veering so that it may fall in inhabited country.

V-2 Record Height Is 116 Miles

Highest altitude reached so far by a V-2 is 116 miles. One Wac Corporal rocket developed in this country, attained a height of 250 miles with the aid of a V-2. It was carried up to about 20 miles on the V-2, then fired from there, and the extra push of the larger rocket added to the Wac Corporal's own power carried it to this record altitude.

No canisters were sent up on this flight, since all available weight was devoted to fuel and instruments and there would have been small chance of recovering anything after a fall from so great a height.

Some of our high-altitude photographs of

the earth were made from the Aerobee rocket.* Less complicated and cheaper to build than the V-2, it has reached heights of 78 miles and will be used to carry on upper air research after the supply of V-2's has been exhausted.

Both the V-2 and Aerobee have gained information about the high upper atmosphere that was impossible to obtain in any other way. The flights have measured the original cosmic-ray particles that come in from outer space before they plunge down into the earth's atmosphere. Except for a few balloon flights, it was possible previously to study only the less-powerful secondary rays created when the original rays strike and disrupt atoms of air.

Ultraviolet rays from the sun have been measured which never penetrate to the earth's surface, since they are absorbed by a layer of ozone that blankets the globe between 20 and 30 miles up.

Vacuum at 80 Miles Up

At about 80 miles high, the rockets reveal, the atmospheric pressure is as little as one ten-millionth of that at the earth's surface, which means that the air at that height is so rarefied that it is actually a high vacuum.

Stepping changes in heat and cold were experienced as the rockets climbed. Over White Sands the temperature drops steadily to about -63° F. from the surface up to 10 miles, and fluctuates slightly for another 10 miles. From 20 to 30 miles the temperature is about 65° F.; it falls once more to -150° F. at about 50 miles, and at 75 miles climbs again to 212° F., the sea-level boiling point of water.

All this information is sent back to the ground by automatic telemetering systems. Temperature, for example, is measured by a thermocouple, made of two different metals welded together. The two metals react to temperature changes and, in so doing, generate a small electric current the strength of which is proportional to the temperature. This varying current is converted into a radio signal which varies in strength in the same way, telling on the ground the changes in heat and cold up there.

Corn seeds and fruit flies have been sent up more than 85 miles on some rockets in an effort to discover whether the powerful bombardment of cosmic rays at such altitudes would cause mutations or hereditary changes in future generations of the plants and

* The Aerobee was developed for the Navy by the Douglas Aircraft Company and the Aerojet Engineering Corporation, under the technical supervision of the Applied Physics Laboratory.

Prachtvolle alte kleine Gartenzäune aus Eisen mit einer kleinen Aussichtsplattform auf dem Dach des einen Teils. Durch die Gitterstäbe ist ein schöner Blick auf den See und die umliegenden Berge zu gewinnen.



Judging for Miles

Straight Jaws:

Rin Grande Is pushed
Sharply Against Head

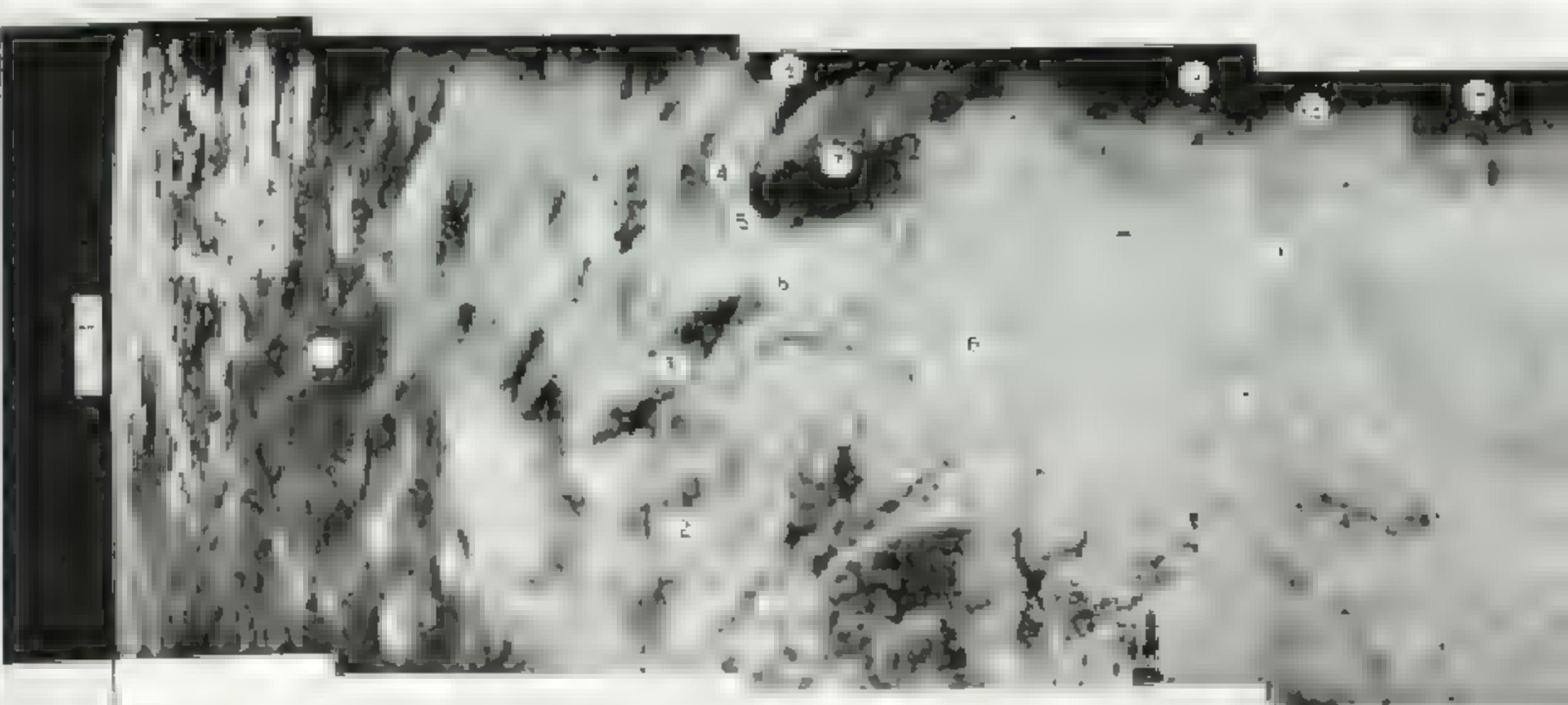
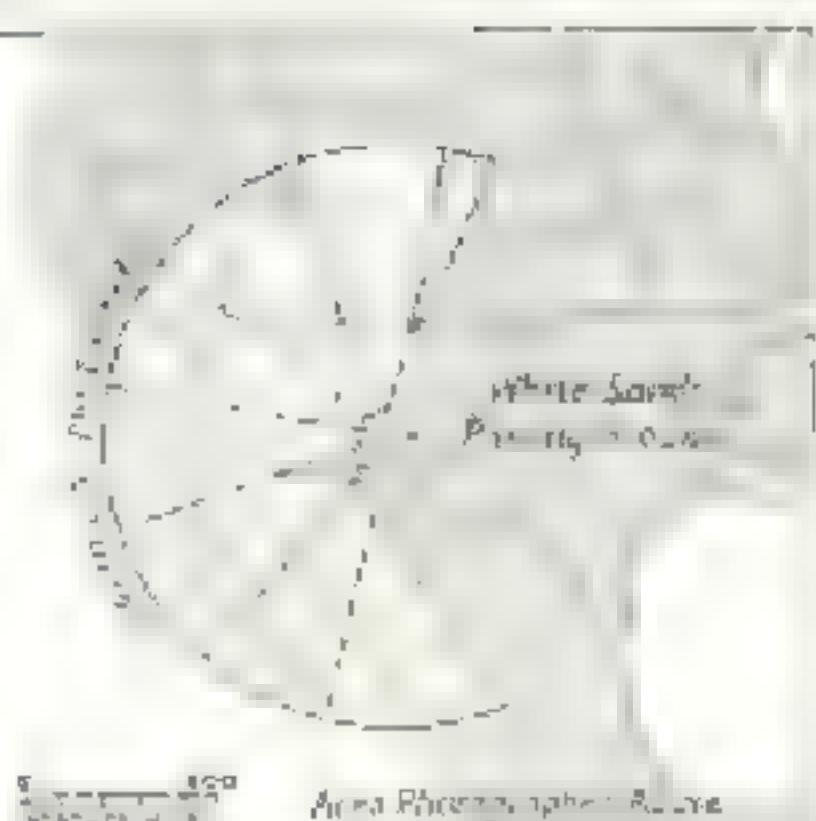
The River East Branch of
the Northern New Mexico is
in the larger right hand
branch of the Colorado.
The river flows from the
head of the valley up to the
town of Taos Springs on the
Colorado River. The river
is about 10 miles long
and has a width of
from 10 to 15 feet.
The water is clear and
the banks are rocky.

Colorado River



Million Squares of Sheep Taken in Sixty Years, Mexican Pacific

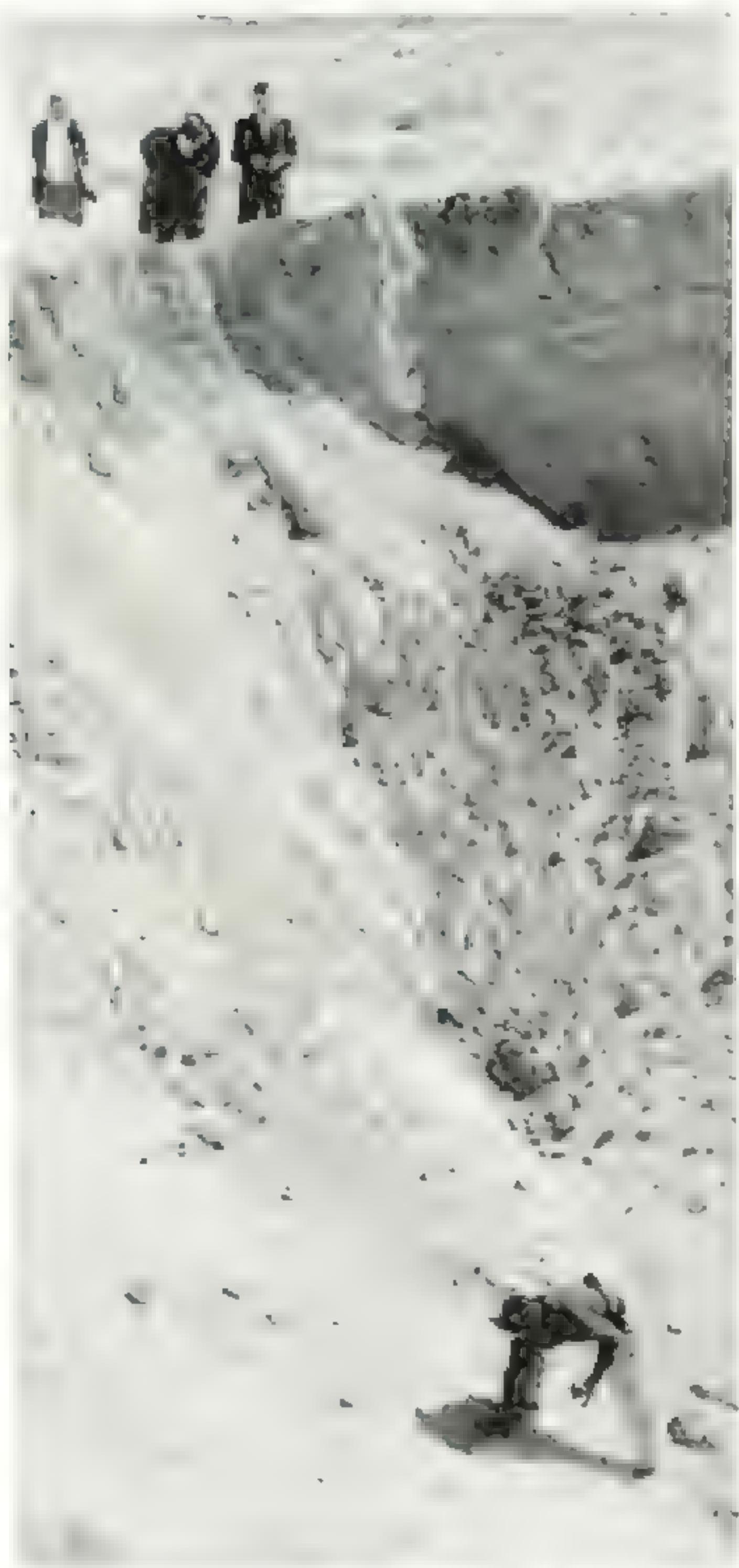
What I mean by this is that the people who have been here before us have left their mark on the land. They have cleared the forests, built roads, and established settlements. These changes have altered the landscape and affected the environment. In addition, they have brought new cultures and traditions with them, which have influenced the local communities. I believe that it is important to understand the history and culture of the people who have lived here before us, as it can help us to appreciate the beauty and complexity of the natural world.



• West American birds from Central Wyoming, Colorado and Mexico

The following is a list of the most prominent peaks in the Andes, arranged in order of altitude. The first column gives the name of the peak, the second its height above sea-level, and the third the name of the range to which it belongs. The names of the ranges are given in the order of their altitude, from highest to lowest. The names of the peaks are given in the order of their altitude, from highest to lowest.

|4



One Rocket's Impact Dug a Crater 31 Feet Deep

Falling in one piece, the missile struck the earth at a speed of more than 3,000 feet per second and the remains of its outer cover were blown apart in the air at about 10,000 feet. Most V-2's are blown apart in the air at about 50,000 feet. The war head and main body fall separately with much less force. See "V-2's in the World," by Carl P. Rosel, National Geographic Magazine, August, 1955.

insects, but the results have not yet been determined.

Puffs and trails of smoke have been released from rockets to learn the direction of the wind at various heights.

Samples of air at various altitudes have been captured in steel bottles strong enough to survive the impact of a fall. The samples disprove a long-standing belief that helium and hydrogen, being lighter than oxygen and nitrogen, would rise higher in the earth's atmosphere and concentrate at the upper levels. The bottles' contents showed that the proportion of these four gases in the air is no different up to 45 miles aloft than at sea level.

Lonely Desert Scene of Rocket Tests

White Sands Proving Ground lies in south-central New Mexico in the Tularosa Basin, between the San Andres and Sacramento Mountain ranges, about 50 miles north of El Paso, Texas. Its name is derived from the White Sands National Monument, which is located within the proving-ground limits.

The site, chosen after a survey of the entire United States, is flat, timberless, and sparsely populated, making it ideal for the firing of long-range rockets. Cloudless skies prevail about 85 percent of the time, so that rockets can be followed through out their flights by telescopes and cameras.

Army Ordnance is in charge of the proving ground, although units of all the armed services are stationed there, as well as civilian scientists representing many industrial concerns and universities.

Assembly and launching of the V-2's at White Sands is a complicated, exacting process performed by the Genetics Division Company under the technical

aid of the "World's Best Astronomer," by Carl P. Rosel, National Geographic Magazine, August, 1955.



Truck Parked Just Out of Sight on the Way to Recovery Finds Debris from a Failed V-2

When a rocket fails in the White Sands area, search planes locate it and valle radio operators pass the spot to the spotter plane. The spotter plane drops a smoke marker which is picked up by a recovery plane. The recovery plane lands near the point of fall from the air.

cal supervision of Army Ordnance. Many of the electronic parts have deteriorated since 1945, and new ones have had to be made.

All the rocket parts and the scientific apparatus to be sent aloft are carefully tested so that one piece of equipment will not interfere with the operation of another.

Tension High on Flying Day

Tension mounts on the day of a V-2 launching, for it is the effort of many months of work by scores of people all of which would be wasted if anything went wrong. Scientists often work around the clock the previous day, and long before dawn they start the final checkout of the delicate instruments installed in the rocket's war head and main body (page 513).

Three hours before firing time about 10 tons of alcohol and liquid oxygen are pumped into the V-2 fuel tanks. An arm guard is on hand to enforce the strict rule against smoking while this dinner is being under way.

At X minus 45 minutes all roads lead into the

waiting zone. And we flushed off. At X minus 15 minutes a red smoke signal was turned on to take cover in the blockhouse rooms.

At this time, too, the electronic circuits and the instruments in the rocket are turned on by remote control, since they need from one to 20 minutes of warming up before they will function properly. Some of them actually use an electronic oscillator to warm up by power from another oscillator. This is the electronic equivalent of a slow cook before eating.

At X minus 10 seconds the receiver and radio signals are switched on. In this case the instruments in the rocket will probably transmit back to earth the data they collect on the flight (page 521).

Generates 500,000 Horsepower

At the word "Fire!" a switch is thrown that opens the valves in the fuel tanks, allowing a little oxygen and alcohol to flow down into the combustion chamber where it ignites the mixture. If the switch is thrown again, another valve is thrown, starting the pump

and disconnecting the cables that control operation of the rocket before take-off.

Then the V-2 is on its own. As the pumps spray fuel with full force into the flaming combustion chamber, hot gases pour out of the tail with a thrust of 25 tons sending the rocket zooming aloft with an estimated 500,000 horsepower (page 516).

The backward kick of the rocket engine gives a maximum acceleration of 180 feet per second per second, which means that in each second of its flight it travels 180 feet per second faster than in the previous second.

This is only five or six times the force of gravity, less than the "G" force exerted on many a jet-plane pilot pulling out of a dive. A passenger, therefore, might ride a V-2 on its upward flight without harm from acceleration. But he would need an oxygen supply, a pressurized compartment or suit, protection from heat generated by the rocket's speed and from both the heat and ultraviolet rays from the sun at high altitudes, and he would have to get out somehow before the rocket crashed.

In hardly 65 seconds, when the rocket has reached a height of about 20 miles, its fuel is consumed, and it climbs the rest of the way to the top of its flight by momentum.

Automatic Pilot Steers Rocket

So slow is the rocket's take-off that its steering vanes on the tips of the tail fins do not operate effectively at first, and it is kept stable by special carbon vanes projecting into the stream of the exhaust. When the fuel is exhausted, the other vanes take over, holding the V-2 on its pre-set course as long as the air is thick enough to give them something to push against.

Both sets of vanes are controlled by the automatic pilot. In the rarefied upper air, the vanes no longer provide control and the rocket wobbles and spins as it flies.

Other sets follow the rocket's flight to help locate the point where it crashes in the desert. Motion pictures also are made of the rocket in the air with the time, elevation, and azimuth, or direction, bearing recorded on each frame of the film, from which can be determined the V-2's speed, altitude, and position in space at any instant of its flight (page 517).

About 40 miles above the earth, on the rocket's downward course, the war head, containing most of the scientific apparatus, is automatically blown off. The main body then turns end over end, which slows down its fall considerably, so that instruments installed in it have a much better chance of surviving the impact with the ground.

If the war head were left in place, the rocket would plunge down nose first and strike at a speed of more than 3,400 feet per second (page 526).

Exposure 1/500 of a Second

Our cameras are usually installed in the main body of the rocket, pointing out through the side (page 517). Though they are almost always broken up in the final crash, the film is undamaged, and it is much cheaper to build a new camera for each flight than to make one strong enough to survive an indefinite number of impacts at speeds of about 300 feet per second (page 520).

Several types of cameras were used on the V-2 flights. An exposure time of 1/500 of a second at f:5.6 was fast enough to compensate for the rocket's motion. Eastman Aerographic infrared film with an 89A filter proved to be the best film-filter combination.

Pictures in color also were taken, but were not too successful from altitudes above 30,000 feet, since color film penetrates haze little better than the human eye. Generally speaking, color film is most effective for photographic reconnaissance below 20,000 feet, and infrared for higher altitudes.

Though not a true guided missile itself, since its course cannot be controlled after take-off, the V-2 rocket was a forerunner of these few types of weapons that promise to revolutionize modern war. Some of the new knowledge of the upper air gained by the V-2 flights is proving useful in the design and development of guided missiles.

Types of Guided Missiles

A true guided missile is a projectile that can be steered to a target by remote control, or that seeks out the target after it is fired, changing its course radically if necessary.

Such missiles may be used eventually by planes against hostile planes, enemy missiles, or ground targets. They also may be fired from the ground against fast jet-powered enemy aircraft or missiles, or at long range against ground targets in enemy territory.* Rockets, which are not guided missiles, have seen action as weapons in Korea as well as in World War II.

People working with rockets often are asked when one will be sent to the moon. The answer is that it probably could be done today, if we felt like spending the millions of dollars that such an exploit would cost.

* See in the *National Geographic Magazine* "Flying in the Dark with Missiles," "Firing It the Dumb-Dumb Way" by Frederic G. vonburgh, September, 1950, and "Air Power for Peace," by General H. H. Arnold, February, 1948.

Lake Sunapee's

Golden Trout



New England's Rare and Beautiful Golden Trout Live Only in Lake Sunapee

Long ago, before the days of dams and powerplants, Lake Sunapee was a natural lake. It was fed by the Contoocook River, which flows from the White Mountains through New Hampshire and Vermont. The river brought water and nutrients to the lake, supporting a rich ecosystem of fish and other aquatic life. Over time, human activity changed the landscape. Dams were built on the river, changing its flow and water levels. This had a significant impact on the lake's ecosystem. The water became more stagnant, and the fish population changed. Today, the lake is home to a unique and rare species of trout known as the Golden Trout.

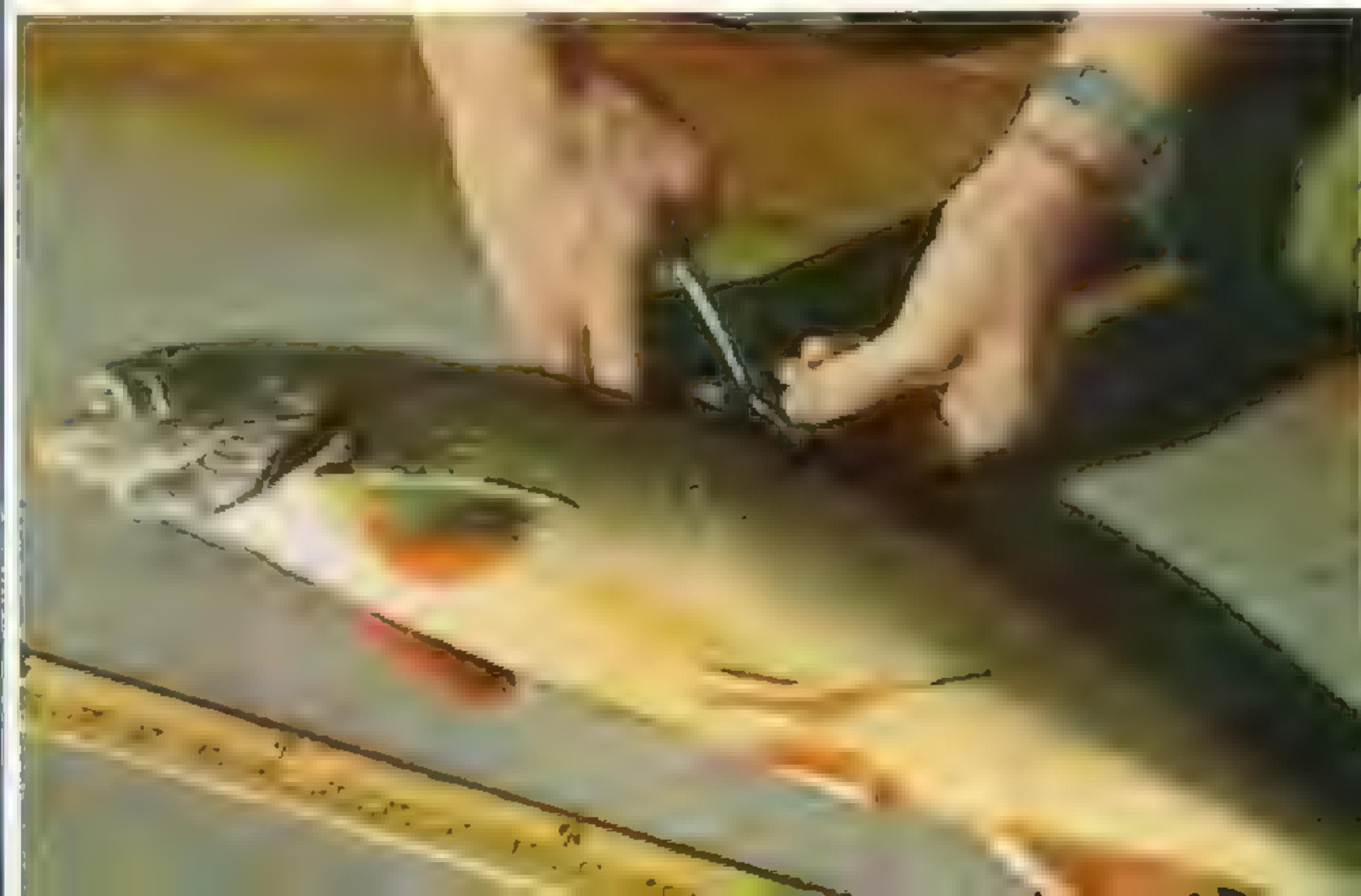


* At Midnight Gathers Waiting Host Fish Biologists Take Stock

THEIR FISHES ARE IN DANGER. THE MOUNTAIN streams of Colorado's San Juan mountains have been invaded by trout from the Arkansas River. The new species has spread rapidly, and biologists fear that it will soon drive the native cutthroat trout to extinction.

* Some Trout Like Autos, Wear Numbers; This 21st-century Is Tagged on a Limb

The most effective way to protect the cutthroat is to keep it from getting mixed up with the invader. Now, to prevent this, Colorado's Division of Game and Fish has taken to marking trout with numbers. The numbers are painted on the fish's fins, and the fins are cut off so they won't grow back.





* The Iron Sheep Strengthens Glass in
Greece; He's Anesthetized

All Greece is abuzz over the iron sheep that has been anesthetized and is being used to strengthen glass. The iron sheep is a symbol of strength and resilience, and it is believed that its presence will help to protect the glass from breaking.

* Golden Males Wear Flaming Dress
in Fall, Their Nuptial Season

The golden males are wearing a flaming dress in the fall, their nuptial season. This is a tradition that has been passed down through generations, and it is believed that the flaming dress will bring good luck and prosperity to the males.





[16] *Journal of Clinical Endocrinology*, 1991, 131, 169–174.

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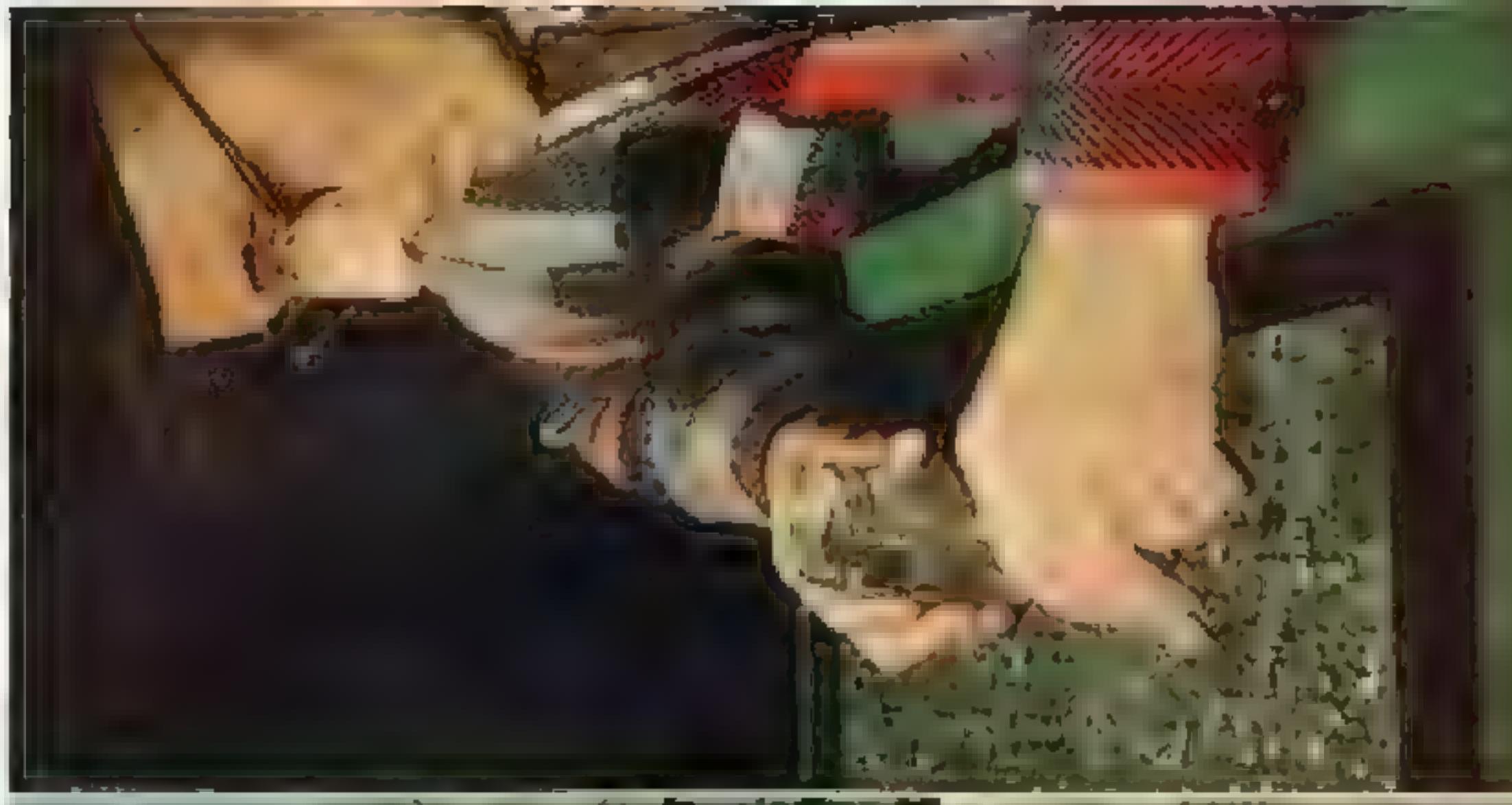
卷之三

1. *On the 1st day of the month of April, 1863, at the*
2. *age of 18 years, I, John C. H. Smith, do hereby*
3. *certify that I am now a member of the* Methodist
4. *Episcopal Church, and that I have been a* Methodist
5. *Episcopal* Christian for the past 18 years.

The figure displays a gel electrophoresis pattern with four lanes. Lane 1 contains DNA from *S. enterica* serovar *Heidelberg*, lane 2 contains DNA from *S. enterica* serovar *Infantis*, lane 3 contains DNA from *S. enterica* serovar *Enteritidis*, and lane 4 contains DNA from *S. enterica* serovar *Salmonellae*. The gel shows distinct bands representing different genetic profiles for each sample.



WILLIAM, BAPTIST, AND JAMES, SON OF THOMAS AND ELIZABETH, WITNESSED THE BAPTISM OF JOHN.



Hillbilly-style clothes are very popular with the young people here. This boy, from the hills of Kentucky, is dressed in a "white-linen suit." He is wearing a "white-linen shirt," a "white-linen vest," and a "white-linen jacket."



A Living Lesson in Biblical Names from Scripture Textbook

11. In a similar manner, the last group will be treated by the last upper row of blocks. The first two rows of blocks will be left in place, and all other rows will be shifted up one position. This will result in the last group of blocks being shifted up one position.

- * Singapore Is Tested At Year Round for Any Change That Can Take

The 0.0005% dilution of the sample
produced a maximum absorption at
a wavelength of 360 nm. The absorption
maximum of the pure solution was at
the same wavelength. The peak extinction
coefficient of the sample was 1.0.



Men Against the Hurricane

By ANDREW H. BROWN

TIT WAS what the flying hurricane hunters call a "hairy hop."

A U. S. Navy plane "Five Uncle 34" staggered through a savage whirl of wind, cloud, and rain. The speeding aircraft bucked the bluest, toughest, and most ruthless of storms, the black-browed hurricane.

A scant 300 feet beneath that dark-blue Privateer of Patrol Squadron 23, 100-mile-an-hour winds of a hurricane ripped the Gulf of Mexico to shreds of foam. Torrential rain rasped against the plane's windshield.

The wings waved wildly. Rivets strained as severe turbulence racked the thin skinned craft. Pilot and copilot both wrestled with the controls, struggling to hold the plane level. Surely the "eye" of the spinning storm couldn't be far away now! (The eye is the nearly calm center of the hurricane toward which its great winds converge; pages 543, 548.)

Punching the Hurricane's "Eye"

Suddenly and gratefully the Privateer mushed into nearly still air. The black and stormy weather dropped behind, cut off sharp as a wall. The eye, at last! Clouds were high, thin, and whitish. The orange sun was a haleful, sickly orb.

Here the flying was smooth and good. Everybody relaxed. There was even time for a quick cup of coffee while the aerologist fulfilled the main purpose of the flight—reporting by radio the location and intensity of the hurricane.

The quiet eye was only about 20 miles in diameter, so respite was brief before the swiftnmoving plane angled cautiously out of the calm core. Then it barreled back through the wicked weather to safety and home base.

Few peacetime assignments of our Navy and Air Force air crews match the hazard—and the usefulness—of flying into the wildest and most destructive of all storms, the howling hurricane that ravages the Spanish Main. Reports sent back from these airborne weather stations are crucial in preparing warnings to gird against the great storm's blows.

Hurricane Is Bully and Blowhard

A hurricane is a bruising bully that will knock down anything it can. It kills and crushes indiscriminately. The name "hurri cane" apparently derives from the Caribbean Indians' *karakan* ("big wind") or *maraka*, god of stormy weather to Guatamala Indians.

People are prone to think an atom bomb explosion the most tremendous display of

power known to man. Yet, as one weatherman put it, "The atom bomb to a hurricane would be just like a flea to an elephant."

The late Dr. W. J. Humphreys, veteran of the United States Weather Bureau, studied the physical force built up by tropical cyclones. His conclusion: "A full-fledged hurricane generates more energy than 1,000 atom bombs exploding simultaneously."

A hurricane can lift two billion tons of water a day (in the form of water vapor) and dump the whole enormous load in rain within 24 hours. Two such storms, each lasting ten days, could fill the entire basin of 115-mile-long Lake Mead, the huge reservoir behind Hoover Dam.

Nature on the rampage is nowhere more impressive—and frightening—than on hurricane-lashed seas. Capt. Irving Johnson, NATIONAL GEOGRAPHIC contributor, weathered and briefly described a hurricane experienced in a racing sloop in the Atlantic.

"We were shaken around like beads in a rattle," he related. "Calking sprayed out of the deck planking as great seas wracked the hull. The storm drove the vessel running under bare poles, at an unbelievable speed of 10½ knots (12 mph) by the log!"

On land, one hurricane last year felled steel highway signs as you might bend a strip of soft lead (page 542). It beatheated parking meters as easily as a small boy tops daisies with a stick. A steel radio tower, 190 feet tall, toppled before its weight of wind.

More Dreaded than Spanish Fleet

At the outset of the Spanish-American War President William McKinley called in James Wilson, his Secretary of Agriculture. (The U. S. Weather Bureau, today part of the Department of Commerce, at that time operated under the Department of Agriculture.)

The President said: "Wilson, I am more afraid of a West Indian hurricane than I am of the entire Spanish Navy." The present West Indian weather service, later greatly expanded, was soon started as a war measure.

Grandmother of all modern hurricanes was the New England storm of September 21, 1938, that swept up out of the south to pummel Yankee land.

This gusty tramp from the Tropics "picked" 4,000,000 bushels of apples in 24 hours. It tipped through New England forests like a colossal electric shaver, clipping off and damaging a quartet of a million trees, including



Dean of Hurricane Forecasters, Grady Norton Has Lived with Big Winds for 19 Years

He stands high above the Miami water front which he has chosen. Norton is senior member and set up in 1941. The U. S. Navy and Air forces scattered across the Miami area that

tide the nonhouse office of the Weather Bureau in administrator of the Joint Hurricane Warning Center at Miami. Private Teletype links the three

a million cherished shade trees. The storm crushed 26,000 autumn leaves and whitened windows of Vermont houses with ocean spray carried 120 miles from the sea."

The mighty blow brought hordes of salps (strange deep-ocean denizens) into coastal harbors, hurried tropical birds into unfamiliar down East surroundings and knocked down many wires that telegrams were sent from Boston to New York City by way of Boston.

Never has a recorded hurricane caused greater property loss. The storm cost about \$600,000,000. New England won't pay more than a quarter of a billion dollars.

From earliest days right up until the 1920's and 30's, hurricanes kept a grisly tryst with death. Storm casualties frequently ran into four figures.

The "old" storms took such a fearful toll

* See "Geography of the Hurricane," by E. R. Barnes Colton, NATIONAL GEOGRAPHIC MAGAZINE, April '49.

of lives not because they were more violent, but because of lack of warnings. More primitive methods of those days for coping with emergency conditions and disease added to the death lists.

The September, 1928, Florida hurricane killed 1,836 people. In contrast, as a result of Hurricane Agnes, August, 1949, only 16 persons died. Yet this big blow closely followed the course of the blusterers of 1928.

Hurricane Watch Is International

What has brought about this striking reduction in hurricane fatalities? What are men doing to cope with these storms, apart from saving lives?

Last hurricane season I went hunting the masters. My first call was at the U. S. Weather Bureau headquarters in Washington, D. C., where hurricane specialist Ivan R. Camphill told me:

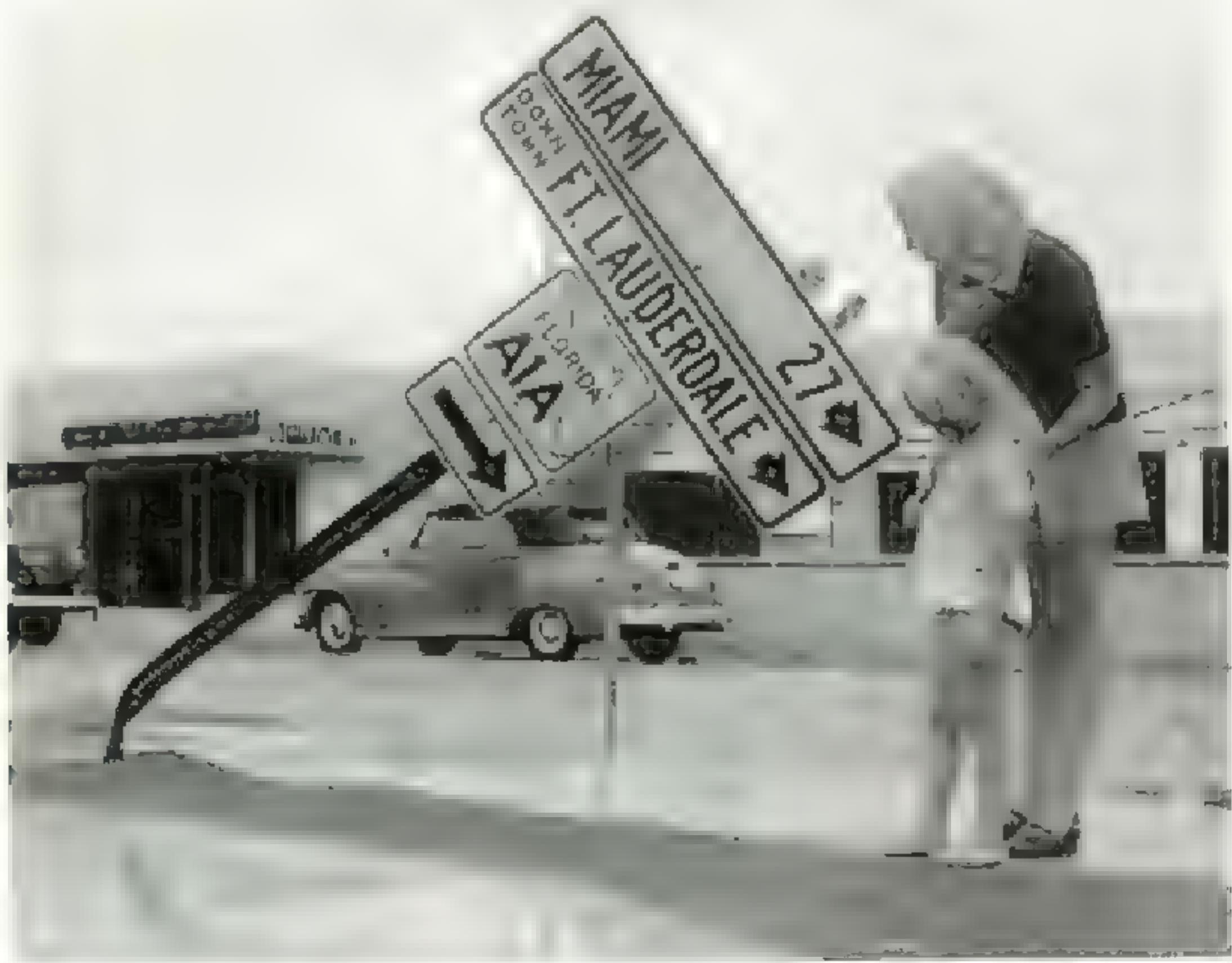


Up Go the Dread Red Flags That Warn of an Approaching Hurricane

From the sky comes the warning that it is time to leave the coast and go inland—especially the poor. New Orleans Weather Bureau says the low pressure of the approaching Hurricane and its accompanying gale force winds have begun to affect the city.

THE SAVING OF JESUS CHRIST





Even Steel Highway Signs Bow Before the Hurricane's Might

The last of warnings can't prevent some disasters, like the August 1935 one of 1930 knock-down Florida cities that 170,000 boxes of grapefruit (page 54) never reached. The one ever recorded in a hurricane was 166 miles per hour in the great New England storm of September 1938. The greatest single property loss from other tempest in history (page 507, 548)

"To make sure the big surprises don't surprise us, we have to find and follow them. To find them we need all the weather information we can get from the vast area where they grow up or move. Most of that 'hurricane belt' is empty ocean."

Going on a blind search for hurricanes in those watery wastes even with radar-equipped aircraft would be pretty much a needle-in-a-haystack proposition. But once a big or hot or area of suspicious weather is discovered, then the flying weather stations can cover it faster.

"It's like calling out the fire engines," said Mr. Tannehill. "Somebody has to pull the alarm."

To keep track of West Indian hurricanes weather reports are greedily gleaned from hundreds of vantage points dotting the republics in the West Indies and Central America, from British French, and Nether-

lands colonies around the Caribbean Sea, and from Mexico and southern United States.

"Biggest, and blakkest, areas are the open oceans. Reports from ships there have inestimable value," Mr. Tannehill said. "Merchant vessels of all countries join in a voluntary ship-to-ship exchange of weather data. Ships find it a good bargain—trading regular weather observations for forecasts and storm warnings."

Caps sometimes send hurricane reports while crews are fighting to keep afloat. Similarly, isolated observers on isolated cays and islands stick to their posts and keep transmitting reports by radio even after a storm has spread devastation all around them.

Surface ships try to flee or to avoid severe weather, especially hurricanes, by promptly changing course.

Next I flew to south Florida, deep in the seasonal hurricane area, to visit the Joint



"And There I Was Five Miles Up, Looking a Hurricane Right in the Eye"

The author of this column, Captain George W. L. Johnson, was shot near Key West from an Air Force plane flying through the eye of Hurricane "Floyd" in 1942. The funnel-shaped funnel cloud extends from land or sea to the horizon, top right.

Hurricane Warning Center at Miami. This cooperative activity was set up in 1943, the Weather Bureau, Air Force, and Navy being its controlling members. Its function is to coordinate hurricane warnings and make them more accurate, complete, and effective.

I am up a 520-mile hill the first day since the two widely separated offices in Miami and vicinity are the cords of the Joint Center that together on a private three-way Teletype circuit nearly as easily as if they shared the same office.

Three Services Track Hurricanes

The Hurricane-warning trio I interviewed comprised George Norton, in charge of the Miami office of the Weather Bureau; Comdr. Edwin T. Haning, USA, officer in charge, Navy Hurricane Weather Central; and Capt. Bush W. Edson, U. S. Air Force brigadier general. In May 1943 Capt. Paul K. Drisshel took command of the Navy unit.

Much of the Joint Center's most vital information comes from aerial weather-reconnaissance flights into the growing and moving storms.

Tracking hurricanes with airborne weather stations, an outgrowth of experimental flights of World War II, has now fully "come of age." Today Air Force aircraft based in Bermuda, and Navy planes in Florida and the West Indies, keep an alert watch from June to November. They're ready to roar out to meet the hurricane at the drop of a barometer anywhere between northwest Africa, Panama, and Newfoundland.

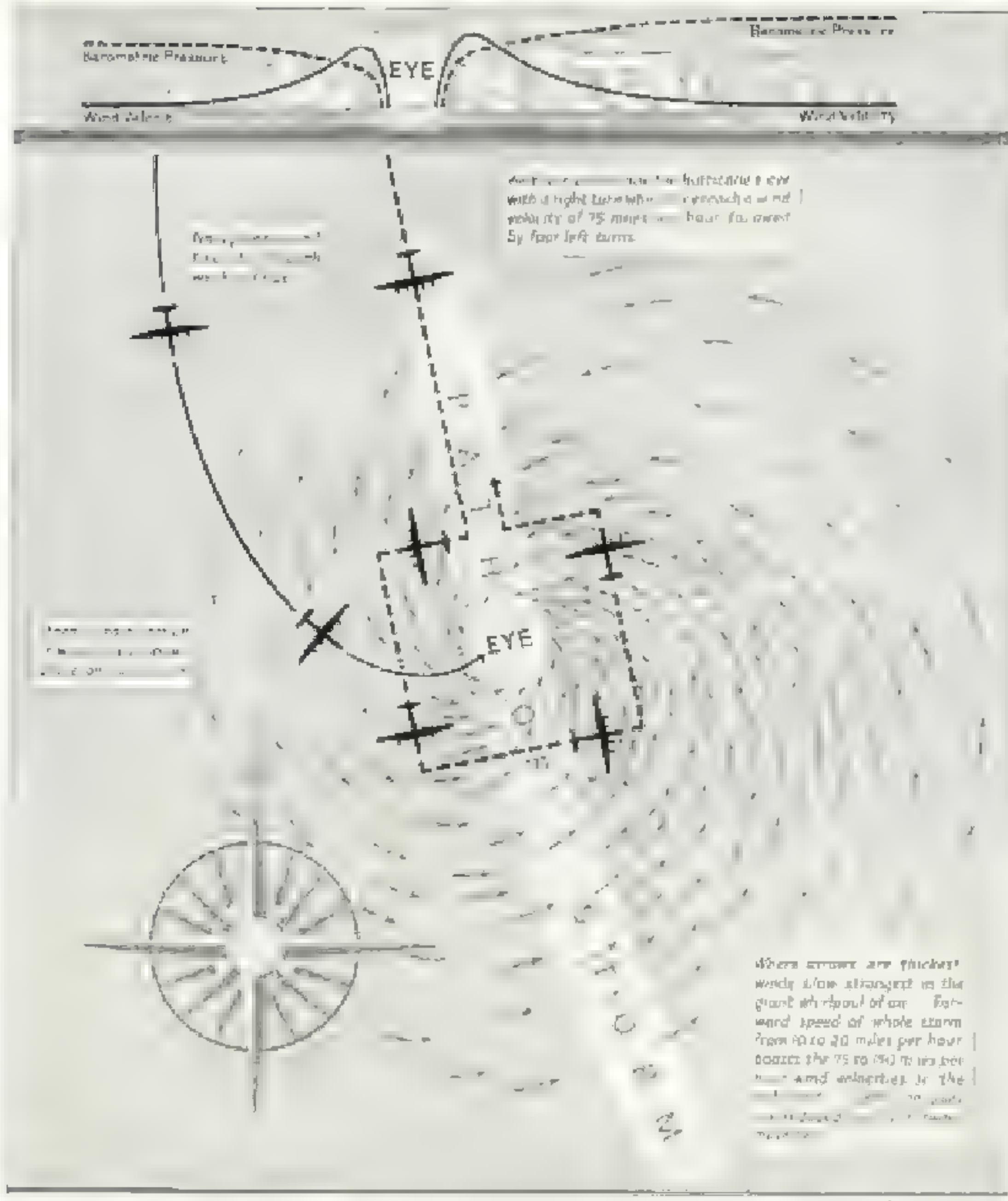
Overlapping land, ship, and aircraft reports, the Weather Bureau, Air Force, and Navy meteorologists of the Joint Center agree in advance on the substance of their hurricane warnings, which are released simultaneously.

Bulletins are independently issued. The Weather Bureau's job is to warn the public and merchant shipping; the Navy alerts its



A Race Track Trembles as a Shelter When a Big Typhoon Strikes

Typhoon Joe, which hit Hong Kong last October, caused the most damage ever suffered by that city in its history. The Peak, Victoria Harbour, Kowloon, and surrounding districts were inundated.



Spiraling Hurricane Winds Blow Hardest Near the "Eye," Where Pressure Is Lowest

Main winds are low pressure winds, which are caused by the detection of the storm's forward movement. This applies only to hurricanes north of the Equator, whose winds spiral clockwise. South of the Line, winds spiral clockwise, and so are strongest to left of the storm's forward course (page 518). Cross section at top illustrates how wind velocities ten h. maximum near center, then decrease on outer. Barometric pressure is lowest in the eye, tending toward the storm's rim

ships at sea and naval installations; and the Air Force issues advisories to its bases and to Army establishments.

The Weather Bureau issues an "Early Warning Service" which alert Army and Merchant Marine. But it has to compete

in stride from the penthouse of the Miami Technical High School building (page 525).

As middleman between storm gods and Hurricane-warning public, the U.S. Navy is one of the most important agencies of the nation. Today, Hurricane warning is a national



Flood Watcher Recoils from Stunning Crash of Monster Wave Against Sea Wall

Much of the roadway leading to Major Haalover inlet, north of Miami Beach, collapsed under terrific pounding by hurricane-driven swells of September 11. Repeated damage to this stretch forced U. S. Army Corps of Engineers to open a new breach in upper embankment from closing waves. Now, huge swells continue on a beach which faced a distant hurricane's approach. (The waves can travel only 10 to 20 miles an hour, but east winds can send waves rolling ahead at 20 mph (page 55c).)

tion on the beaches during hurricane season.

Norton rarely sees the fires as he sees the great waste lines of Father Noah, yet the Army's population was a mere token force compared with the army of men, women, and children who gave life and limb to the tireless labors of Norton and his military associates.

Hurricane, "Public Enemy No. 1"

"When a hurricane is on the loose," Norton told me, "this country loses what you might call an orderly mechanism. All local news services, radio, television, as do the major news association services. The Red Cross stations a man at my elbow, ready to alert disaster preparedness facilities."

"As the hurricane moves in, we try to figure out where and how hard it will strike. We give people time to batten down their property and take cover."

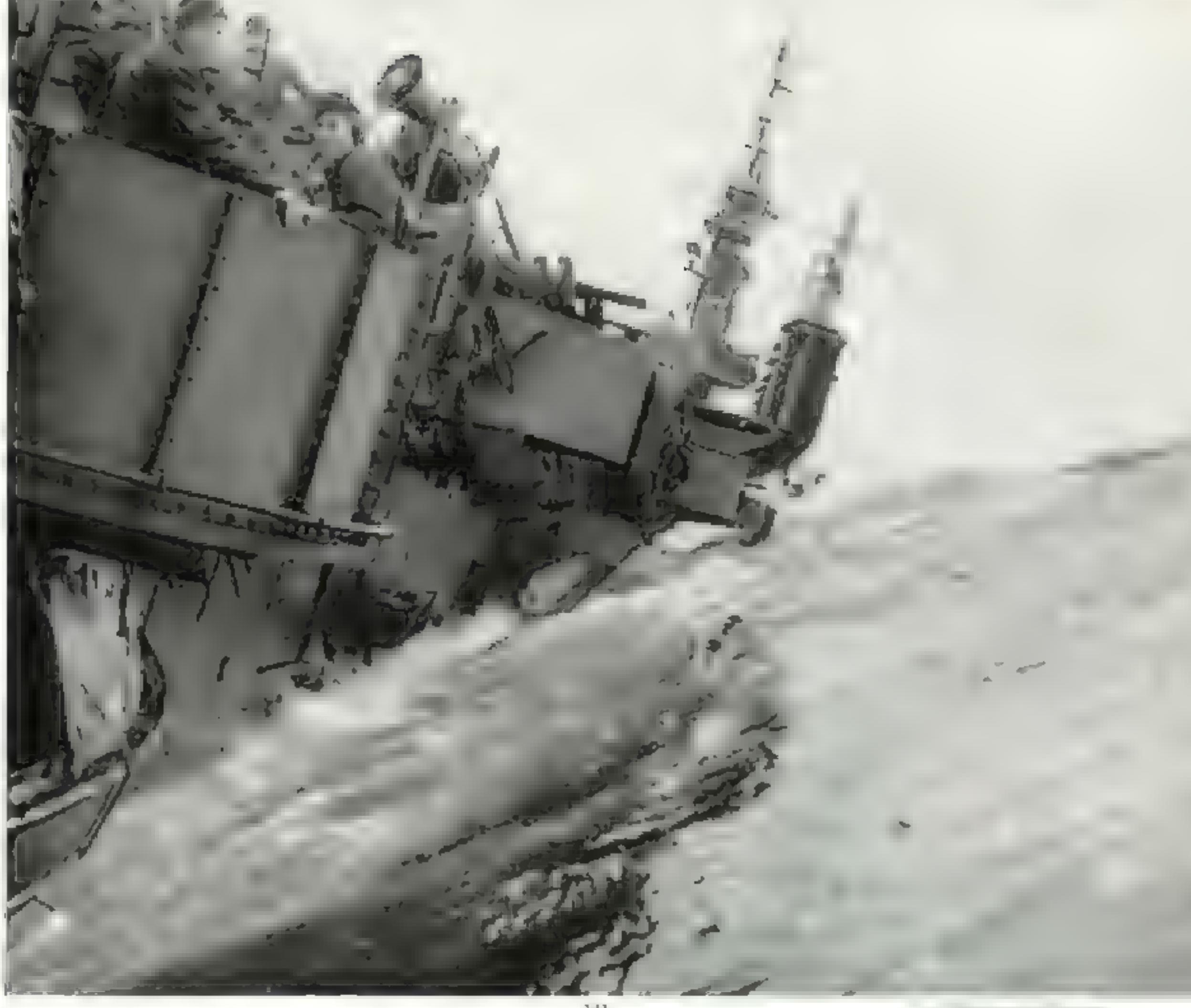
Commander Harring, Captain Dillinger,

and I keep in close touch," he continued, "on the Teletype line linking my office with Navy and Air Force bases in the state. At least half an hour later, however, we reach no agreement on the exact intensity, speed of movement, and probable future course of the storm."

Norton explained that most hurricanes never come near continental United States. To be on guard for the occasional storm that does strike the mainland, much of the elaborate warning system has been set up.

When a hurricane levels sights at the coast, the Weather Bureau starts its advance to the target area two days in advance before it hits. Before last August's monster spent its force, the Bureau had issued 14 warning and warning bulletins (page 55c).

Within 15 or 20 minutes after a warning goes on the wires it's best to turn your international radio on. That way, instead of north



Nearly Rolling Her Flight Deck Under Carrier Fought Waves Through a Typhoon

The carrier *Essex* was nearly rolled under by the waves of a typhoon in the South China Sea. The ship had been hit by a series of high waves which caused her to roll over so far that she nearly capsized. An American aviator who was flying over the carrier said that the ship was "rolling like a barrel" in the South China Sea.

Not far off shore, the carrier was struck by a powerful typhoon which blew through the ship for half an hour.

Each time a typhoon comes along, it starts a new alarm of alarm. At the moment, there were many sailors on board who had never seen two or three typhoons before. By the time you wrote this, we had been through ten typhoons without losing a man or being driven from our course.

Where the Storms Are Born

Principal beneficiaries of the typhoons are Japan, the southern part of the Gulf of Thailand, the Formosa Islands, and the West Indies. Men who live in these regions are keenly sensitive to the approach of the big storms. They will be taking no chances. They are merchantmen and truck farmers, men of small and medium size in the Gulf States, cotton growers, fruit and the Caribbean.

They are all looking forward to the day when the typhoon will pass.

Mr. Norman Lear, director of the Weather Bureau, has said that the typhoon which passed over the Formosa Islands probably originated in the western North Atlantic.

The West End of North America may blow up again. Mr. Lear remained waiting to the Cape Verde Islands of North Africa. "The typhoon is here," placing his pen over the Bay of Campeche, the western edge of the Gulf of Mexico.

It may wind up in the Gulf of California where it is the main Atlantic Ocean between latitude 20° and 30° N.

All the salty old timers, Northern Americans, between the trade winds blowing from northeast to southwest, air movement is left to wind systems. There is little to little water vapor evaporation motion.

No one yet understands just how this com-



"The Way I See It, She's Headed Right Up the Florida Peninsula!"

Capt. Erwin T. Hauke points out to a fellow Navy meteorologist his forecast of the future path of Hurricane "Goliath" over Palm Beach, Florida. Until to early, Hurricane "Goliath" had been moving westward across the Gulf of Mexico from the Yucatan Peninsula toward Central Florida. The map is an enlarged extract from a weather map showing pressure areas and fronts that pass through places of equal barometric pressure.

hiphazard of conditions starts the storm to racing along its fearsome mechanism of boiling clouds, fierce wind, and steaming rain.

How the Hurricane Takes Shape

Birth of a hurricane begins with warm air, heated by the sun, rising from the surface of the ocean. The air expands as it rises, loses heat, and sinks again. This causes the air to spiral upward, creating a low-pressure area at the bottom of the column. The air then spirals down to a chutney-like funnel.

As the air rises it cools, and the water vapor in the air condenses. In this process the moisture gives up the heat that originally transferred it from the ocean below. Thousands of tons of heat are forced in a hurricane, which suddenly turns on heat and feedback into the air. This heat, adding to the force of the air, completes the cycle of birth of a hurricane's power.

As the air goes spiraling upward, more hot,

moist air rushes inward from all sides to replace it and keep the updraft moving.

Motion of the earth rotating eastward deflects these impounding currents to one side. This starts the air spiraling counterclockwise and the rising column of air begins to spin this way too, when north of the Equator. South of the Equator the spin is in the other direction. Wind speed increases as the air spins and reach 75 miles per hour. Drawing ever tighter about the center, the great winds form a rotating ring around a central column of calm air, the "eye," 15 to 30 miles across (page 546).

In the eye the atmospheric pressure is very low, but near the rim of the cyclone where the air is still moving away from the center, the pressure is relatively high. The greater the difference in pressure between the center and rim of the storm, the harder the winds blow (page 545).



Loyal Pet Dog and Rugged Client Land Space on a Navy Storm-rescue Craft

When a small island of a hurricane made a hole in the Everglades, the Navy sent the courageous *Woolly* to the rescue. *Woolly* has spent his life in the flat low-lying swamps of the Everglades, where he can't even see the sea. In such heavy and uncertain bottoms, by buttresses rising at long intervals from the bottom depth (page 4).

A storm in the hurricane is like a phonograph record. It's a flat disk of swirling winds 200 to 300 miles across, but only 7 to 12 miles in vertical thickness. It may cover an area as large as Alaska. The winds blow around the center from 50 to 60 per hour or more. But the storm as a whole moves at a modest 10 to 20 miles per hour, just as a top, spinning at 1000 rpm, may move 1000 inches a minute.

It may take anywhere from a day to a week for a full-blown hurricane to develop. Between the eye and the eye-hole most frequently also lies a sea, maybe 10 days later and 3000 miles from its birth date.

A Hop with a Navy Storm-chaser

Roundline second base on my tour of the Joint Hurricane Warning Center, I visited the Navy at Master Field, a few miles north of Miami.

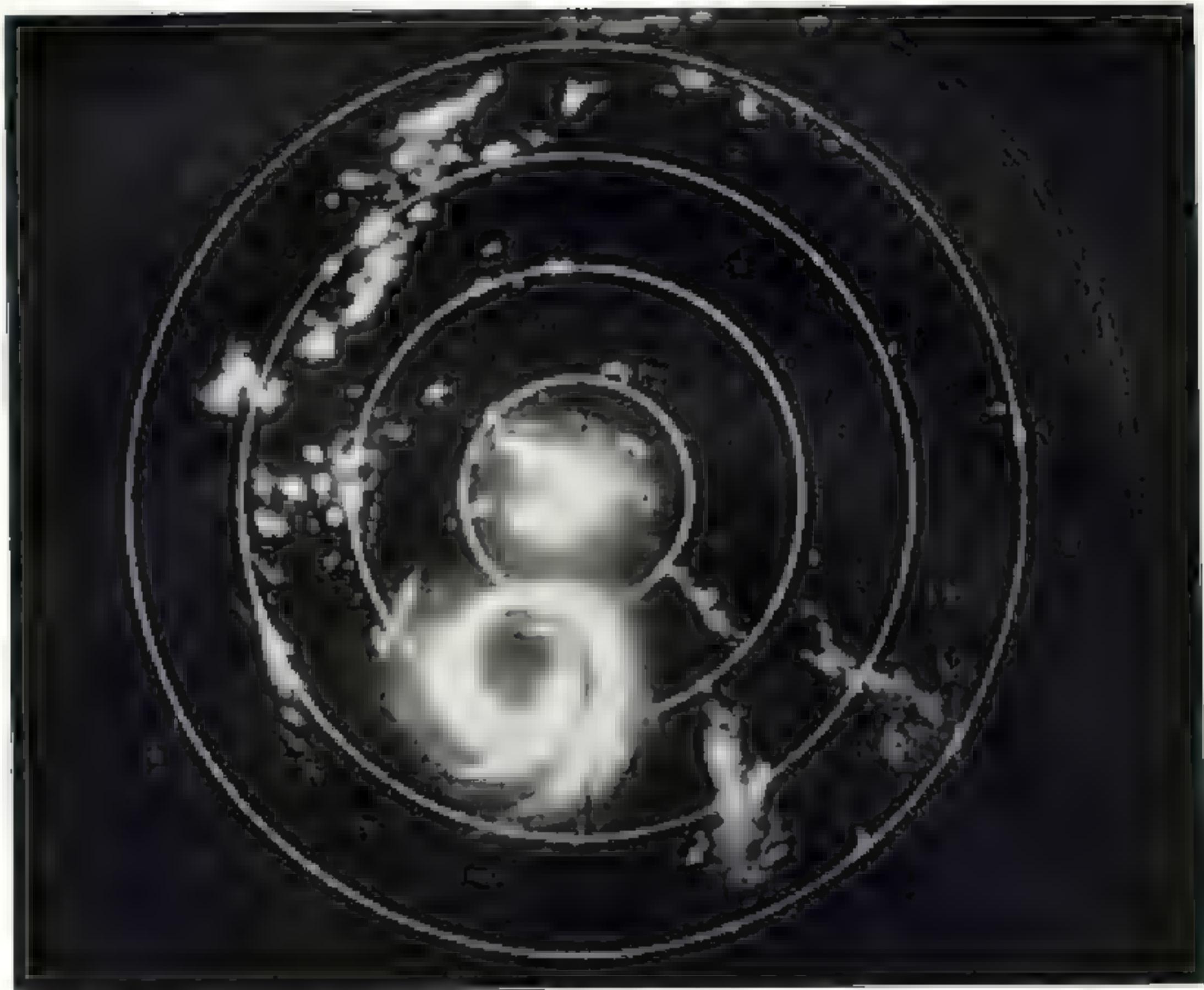
Comdr. Edwin T. Harding showed me the

workings of the Navy Hurricane Weather Central, which is command. Harding also had a personal control over the reconnaissance squadron based there.

"Our 'recon' aircraft try never to let a hurricane pass us of sight for more than a few hours," he said. "We have an aircraft taking off in an hour to look at a suspicious cloud over the Atlantic. We will do the same."

So far one of the Navy's hurricane-hunting Privates we saw were lumbering eastward along the Gulf Stream.

Equipment crammed the high-talled PB4Y-2. There were the aerologist's radar altimeter and the radar scanning set to search out the actual eye of the storm. Navigator and reporter kept their hands over the drift meter which aids navigation and gives wind speed by "reading" the ocean waves.



In the Radar Scope, the Eye of an Intense Hurricane Shows Up Like a Spiral Nebula

Atmospheric pressure is measured in millibars, and it is the difference between the pressure of the air outside and the pressure inside a barometer tube that gives the reading. The greater the difference, the more intense the wind.

The wind direction is indicated by arrows pointing toward the eye, which give a general picture of the wind pattern. The eye is surrounded by a ring of turbulent air, and the eye itself is a zone of relative calm. The eye is usually about 10 miles in diameter.

Like a sunspot, the eye of a hurricane is a dark spot in the center of the storm.

It is surrounded by a ring of turbulent air, and the eye itself is a zone of relative calm.

But there is a difference. The eye of a hurricane is a dark spot in the center of the storm.

On our B-52 flight we had a small, heavy load and had to make two refueling stops along the way, so we got to see both the eye and the dark. There

wouldn't have been any point in flying over the eye of a hurricane.

When we were flying over the eye of a hurricane, we could see the eye clearly, but the rest of the storm was obscured by clouds.

The eye of the storm is the center of the low pressure system. Approaching the eye, the air slows down, and it is difficult to fly directly into the eye.

Navy Penetrates 80 Percent of "Eyes"

Navy and Air Force planes now conduct flights from the surface down to 10,000 feet. Navy patrols 100 miles offshore every day, and they have found that flying conditions generally exist



When the Weatherman Walks Into a Hurricane, Menials Quickly Hatten Down

Menial work—such as mopping up after a storm or carrying supplies—can be exposed to the elements without serious effects close to the center of a hurricane. Menial tasks, however, can become dangerous when the storm moves into the eye.

out the hurricane core. Weather crews will break in under the eye to keep a tight fit of ocean waves and streaks of foam and spray cleaned up with the wind.

Air Force aircraft more often locate the center by skirting around it, especially at low altitude where it would be needlessly dangerous to fly through lashing winds near the eye.

The long bend toward the center is punctuated by turns until they find wind of over 100 miles per hour. Then comes the a tortuous rectangular course, bringing the crew successively to three other points on the eye of the storm where 70-mile winds are still. At the center of the eye formed by the right curve, the hurricane begins to turn again.

When fuel reserves and daylight allow, the weather crews fly into the eye as a could do.

The right half of the storm as you look

forward along its path of movement is the more violent. This is because in that area the forward speed of the whole eye—perhaps 20 miles per hour—is offset by the clockwise spin of the hurricane's own winds, blowing counterclockwise (in the Northern Hemisphere). The two movements added together produce the storm's maximum winds.

This effect of extra push is especially true of the east front quadrant, which bears the weight and usually the most turbulent part of the storm.

Conversely, the left half of a hurricane is less unruly. On that side the hurricane's winds blow in general toward the rear, or southward, so the storm's forward motion is reduced. This is the "left hook" through which the "weather plane" makes its way into the tempest.

Keeping the wind on his port quarter, the pilot speeds in to within 15 or 20 miles of



Men Fight for Breathing as an Avalanche of Snow Engulfs a Tucker's Peaks

Two miners were not found alive after the weight of snow forced them to retreat. They had been working at the base of the mountain when the snow began to fall. They tried to climb up the mountain to safety, but the snow was too deep. They reached the top of the mountain, but the snow was still falling. They tried to find a way down, but the snow was too deep. They were eventually buried by the snow, and were found dead.

the storm's eye. By then weather is so turbulent that the pilot's choice as a rule is to head directly for the calm core. He has eight other men with him who have no desire to stay longer than necessary in the hand of violence flogging the eye!

Perhaps 20 or 30 miles away, the radar operator picks up the eye on his screen (pages 550 and 557). It's a glowing image of the crescent-shaped rain bands around the center. He gives the pilot the correct heading and "talks" him inward to the eye, keeping his own eyes glued to his scope.

The a rattles, jolts and bumps in the wildly buffeting air. The navigator quits work and hangs grimly to his seat. The aerologist long since has given up trying to read the drift meter, for the plane's pitching, thumping, and yawing render it useless.

"Fred Clampitt . . . Is Turning Green"

At this frightening climax on one flight, Milt Susan, veteran hurricane reporter of the *Miami Daily News*, jotted down an observation of a fellow passenger: "Fred Clampitt, WDTL news editor, is turning green. No, it's not fear. He's sweating so much that the colored shark repellent in a pocket of his life jacket is starting to run."

After more hard jolts the plane suddenly bursts into the blessed quiet of the hurricane eye. Weather officer and navigator get busy again with their chores.

"In one storm," a Navy pilot told me, "the eye was unusually large and exceptionally calm. We sighted a freighter right in the calm center. We buzzed her for a closer look. The crew were sunbathing right there hang in the middle of it in tranquillity."

As the Navy privateer flights back out through the wall of thundering wind, an Air Force RB-29 prepares for take-off from Bermuda to do its stint at keeping the big storm under surveillance.

Upshot of such a flight is a warning message like this:

WARNING: BASED ON THE EXISTING INFORMATION
WE PREDICT THE STORM TO MOVE WESTWARD
TOWARD THE COAST OF FLORIDA.
WE PREDICT THE STORM TO HAVE A MAXIMUM WIND
OF 120 KNOTS (MILES PER HOUR) OR EQUIVALENT
TO A HURRICANE OF GRADE 4. WE ALSO PREDICT
THE STORM TO MOVE AT A SPEED OF 15 KNOTS (MILES
PER HOUR). WE PREDICT THE STORM WILL
MOVE IN A SOUTHERLY DIRECTION AND WILL
MOVE WITH A SLOW APPROXIMATELY 10 KNOTS (MILES
PER HOUR).

Ashore and at sea there's plenty of time, thanks to reports from the flying weather stations, for everyone to brace for the blow.

According to Warning Center plan, the Navy recon planes schedule their flights to

be in the storm at about 9 in the morning. The Air Force takes off in time to reach the hurricane heart at 3 in the afternoon.

Air Force Flies Storms in RB-29's

To see the Air Force part in the "hurricane shuffle," I flew to Kindley Air Force Base, Bermuda (pages 540, 557).

Thirty RB-29's of the Air Weather Service, in their sonny war paint, seemed out of place in idyllic Bermuda. Beyond the runways, turquoise waters of Castle Harbour lapped coral shores. Pastel homes and hotels jeweled cedar-green hills. The air in October was soft and warm as May.

Lt. Col. Clyde A. Ray, commanding the 175th Reconnaissance Squadron at the time of my visit, said his crews may fly 2,000 miles on one storm-seeking jaunt. Sometimes they make eight hops into a single hurricane.

The RB-29's have to find the eye, swooping across vast stretches of empty sea, then back-track to a small spot of mid-ocean land only 15 miles long and 5 miles wide.

"Don't you 'home' on the Kindley Field range station?" I asked Capt. Robert K. Dusepherry, chief navigator.

"Only in an emergency," he replied. "We must maintain combat proficiency. There's no radio beam over a bomb target."

"So our boys find their way by dead reckoning and celestial navigation. That leaves little margin for error out here where one acre of ocean looks like a million or two others."

Another navigator brawny Lt. Paul Ferris, said it was no good to get too cocky, for, as he sagely put it, "even the best forecaster sometimes gets gored."

The aircraft fly at 15,100-foot altitude or lower on these missions to keep contact with the . . . extremely precise drift-meter readings are necessary for accurate determination of position.

A single flight may flash as many as 20 to 30 radio reports to the Joint Hurricane Warning Center at Miami.

Spotting Cyclones Not Easy

Capt. Hugh W. Elsasser, Air Force hurricane officer in Miami, plots and studies tropical cyclones and informs the Bermuda squadron when the Joint Center wishes Air Force flights scheduled into hurricanes or areas of suspicion.

"Spotting a big storm on the weather map isn't always easy," he pointed out. "Any marked change in the normal trade-wind flow, a 24-hour drop in the barometer, or a report of torrential rainfall—any of these can mean trouble."



Storm Snappers Stake a West Indian Hurricane

From the moment I started the second section of my book, I have been writing it in the same way as the first section. At the very beginning of the first section, I had written a short introduction to the reader, telling him what he could expect from the book. In the second section, I did the same thing, but I also included some information about the author's life and work.

If a library finds itself in a bind and must repeat a long-standing practice that it no longer wants to do, it can do so without fear of being sued when it makes a complaint about that practice.

The first major battle took place at the Battle of Bull Run, fought on July 21, 1861, near Manassas, Virginia. The Union forces were led by General George B. McClellan, and the Confederate forces were led by General Robert E. Lee. The battle ended in a victory for the Confederates, who suffered fewer losses than the Union forces.

Reindeer meat
reindeer blood
and the body
of a deer.

passes in both 1991 and 1992, and the 10 miles of the 12-mile loop. In fact, drivers have stopped using the road west of the town of Marion. The Marion Woods Nature Center has been closed for 14 months.

[View Windows on the Beach™ Details](#)

It is known that the southern Florida salt marshes by Tampa Bay are rather flat. This may be due to the gradual subsidence of the land and gradual settling of the soil. The water table has been high here for a long time, so that there are many salt marshes.

A hurricane seems
swells crashing ashore
sometimes at a greater
distance from the storm
center with a fre-
quency of only four or
five waves to the
inch, compared with
the usual Atlantic
waves which are
about 10 feet high.
The waves running up
the beach when land
winds are light
swell! (Page 546.)

When Gulf of Mexico waters surged into the streets of Galveston, too, Texas, in 1900, wiping out 16,000 homes and reducing the city to matchwood, many residents lifeguarded a "tidal wave." But a tidal wave, strictly speaking, is land that has been inundated by water.

The floods that often subdue low-lying sea-coast areas coincident with passage of a hurricane are caused by water piled up by winds with speeds of 100 miles per hour or more.

Went to see Mr. New
Yorker and it is a
superb library. A
whole collection of
old books and
rare documents.

The last two sections are protected by a metal
gate that has a 20' radius from the center.

A storm surge is a particularly large and dangerous wave when the astronomical (moon) tide is high at the time the hurricane makes landfall. The water level will rise and fall with the tides, and the height of the waves will be increased by the presence of the storm.

Urgent changes and how to make them



Let the Word Serve as a Link between Supper and Service. See Them Through.

so often live in flimsy huts put up together along the waterfront. That's why typhoid fever has such a bad influence along waterways. People don't care very much about living conditions after

The Pacific typhoon and the cyclone of India are the "same breed of cat" as the Atlantic hurricane. But the typhoon uses its claws more frequently and over a longer range. The tally of typhoons is considerably more than 12 a year, compared with seven hurricanes a year in the Atlantic.

The completion of the first part was brought off during the 1880's.



Typhoon Seas Roll the U. S. Light Cruiser *Austin* to Almost on Her Beam Ends

Sixty-foot waves, gusting winds up to 100 miles per hour, and a typhoon which has been battering the Far East for three days have caused the U. S. light cruiser *Austin* to roll so far to her beam ends that she has almost run aground.

For more than four hours yesterday afternoon, with wind strength up to 100 miles per hour, the bow of the heavy cruiser *Austin* was buried in the water.

On the 25th, Air Force and Navy patrols flew out from their air stations in the Philippines to search for the missing *Austin*.

On the 26th, a search plane from the *Austin* flew off at 10:30 P.M. to search for the missing ship. The plane did not return until 11:30 A.M. on the 27th, having found the *Austin* listing heavily to her beam ends.

On the 28th, two search planes were sent out to search for the missing ship, but they also failed to return.

At 10:30 A.M. today, however, a search plane with a homing radio was able to contact the *Austin*. It was the first live contact that the crew had had since the typhoon began last night.

The *Austin* is reported to have been listing

more than 30 degrees to her beam ends, with her stern nearly flat. Waves two and one-half times the height of the ship were breaking over the deck, and the ship was listing so far to her beam ends that the crew could hardly walk across the deck.

Rain continued steadily throughout the day, and high winds made it difficult for the crew to move about the ship. The ship's bell was the only thing that could be heard above the noise.

Now, with a present wind of 100 miles per hour, the ship is listing even more heavily to her beam ends. They are still holding on, however, and the crew is still alive.

The crew of the *Austin* is awaiting orders to abandon ship.

At 10:30 A.M. today, the crew of the *Austin* was ordered to abandon ship.



After a "Hailie Hop," Tired Storm-seekers Relax over Cup of Coffee

Two storm-seekers relax after a long flight in their plane which weathered the jolts at Kendall Air Force Base during the night. They are (left) Fred G. Hines, Jr., and (right) John C. Hines, who were flying from the Midwest to the West Coast. They will continue westward to California.

The Navy and Air Force now have new fast-moving jet and piston-engine fighters and interceptors plus the newest in surface-to-air missiles. All of these aircraft are used for making lightning strikes. Weather observers take a walk before embarking and wait for the next flight over the world's dangerous thunderheads.

New flights are now required New York's 1st Pursuit Wing Naval Air Station, Mayport, and Air Force fighter planes from Bremerton all to descend from Alaska to supplement the daytime fighters.

When the weather is bad, the aircraft are grounded, the experts say. To get out of the picture, the following steps can be taken: know your equipment, know it well. Be the right pilot. See to the flying equipment. If you do all these things, the flying is good, you can fly the airplane, you can land it.

For more information, contact your local

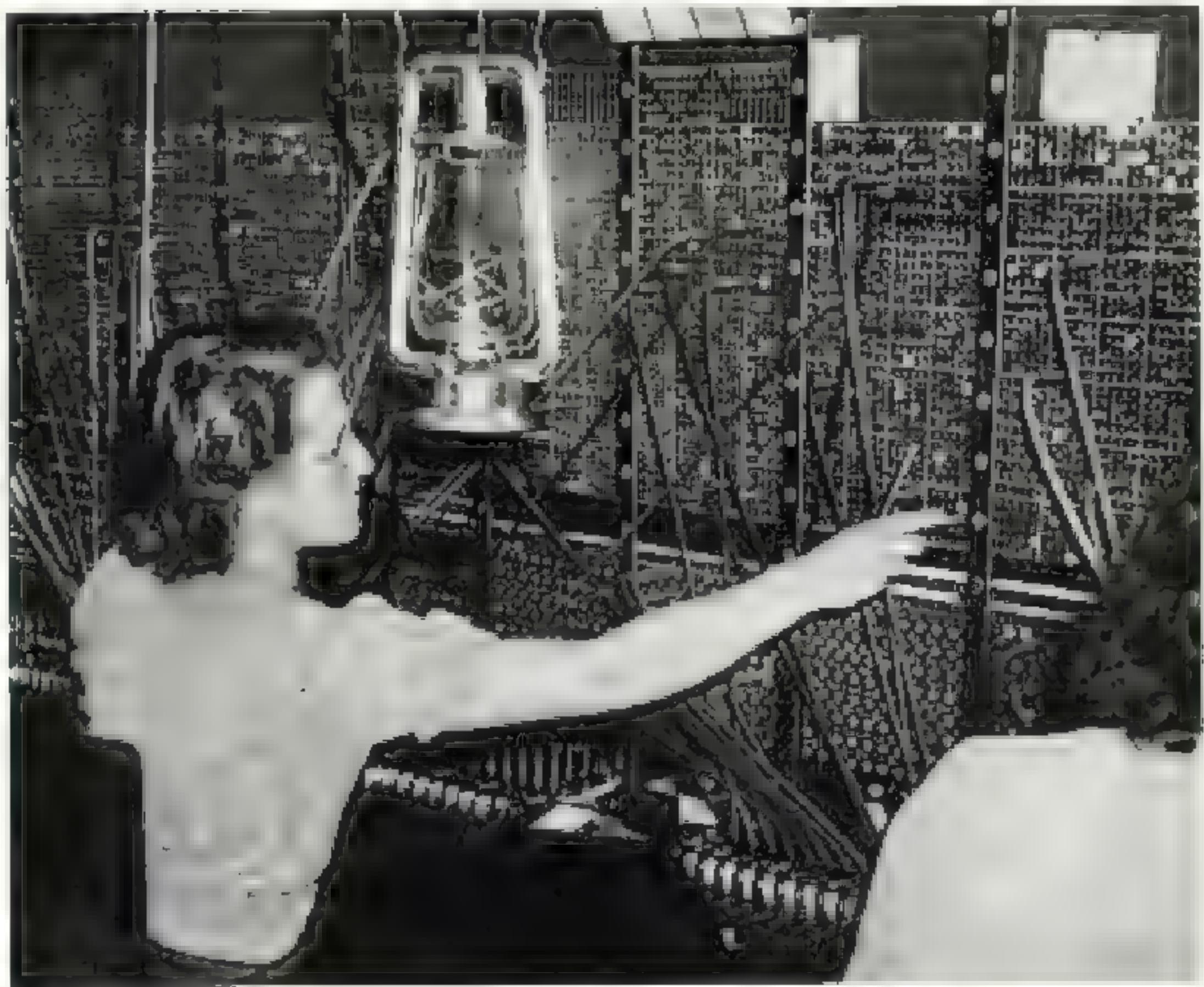
Air Force flight or the nearest Navy flight center or your local weather service.

For more information, see the following: a well-written book, "Clouds, Weather and Places," by Dr. Robert H. Smith; the "Fog and Fogless," by Dr. Robert H. Smith; and "Clouds," by Dr. Robert H. Smith.

Radar Watches Storm Move In

Long-distance radar is necessary for most weather as it is for objects in space. So a high-speed flight warning system is being developed. It uses the same system as the early aircraft, but the longer distance to send signals makes it difficult to determine the exact location of the storm.

At the present time, radar equipment with four views, the four corners and the middle, can be used to indicate the four views.



When the Big Island Struck New England in 1755, Life Returned to the Retesene Adirondack Forests.

After the great New England earthquake of 1755, life returned to the Adirondack forests. The Adirondacks had been devastated by the great fire of 1736, but the forests had not yet recovered.

The Navy Department is employing its own new motto, "For West and East," and probably has set up the first known seismograph to detect the effects of far-off quakes. A team of four scientists from New Haven, Connecticut, has just completed a violent tremor over a long distance. They wanted to establish for sure if it had been the Great Western Earthquake. When they were done, there was no doubt.

The project of the Yale Geophysical Observatory now is an induction coil over. Many of the drilling rigs stand for miles upon miles in the Gulf. The Humble Oil & Refining Company bought and uses most of them at Grand Isle, Louisiana, then applies them to Wartime oil fields.

The field demanded a certain degree of constabulary, "straight backs," and drillers plenty

of time to sit on the roof of their holes to sample rocks.

The nation is coming to realize extra protection for the Gulf coastline of the Gulf States may probably be needed especially at Galveston and Galveston Bay. While the cost of such a project is not known, it would be difficult to put a price on safety, health, and life.

Power companies, oil and gas drillers should stand by while the great American industry is growing. It might help to keep the company and the nation full of detectable tremors.

The Navy in Miami also is pursuing research on microseismic reaction of boat cables. Seismologists have long been able to detect seismic waves sent by tremors almost around the earth. A tremor low enough to travel along the cables can vibrate in the very skin of the earth. These waves



Careful Hands Circle Precious Cards in a Hurricane Rescue

Two experts in the field of paper conservation have come to the rescue of a valuable collection of historical documents. When Hurricane Agnes threatened the practical existence of the documents

activate delicate seismographs in houses that can be set plumb as to give information that will position a house-quake center.

Greeting an Unwelcome Visitor

The author was awakened at 3:30 a.m. by the sound of a敲打 on his window. It was the first time he had heard such a noise in his life.

"It's Hurricane Agnes," said the voice. "I'm here to stay. You'll have to get up and get dressed. I'll be here all day. You'll have to go to the beach. You'll have to go to the beach. You'll have to go to the beach. You'll have to go to the beach."

Now it was time to get dressed.

With this warning issued at mid-morning, the author made his way to the beach with his surfboard, ready to get into the tropical exodus.

Up went hurricane warnings along the water front. Up went houses and fences

with a white one bung between. By day a hundred dogs with square tails kept one another gave the alarm.

The Red Cross mobilized its sick traps and nurses, who had shelter in school classrooms and business buildings.

News spread rapidly and many turned the perimeter of Get off the streets. The ever hot sun shone down and the windows flamed like furnaces. People were forced to the inner shelter. Dozens of children were forced to walk without shoes.

Refugee stocks of canned food pre-cooked foods, gas, firewood, kerosene, lanterns, batteries, money, new flashlight batteries, bows and arrows, flashlights, matches, oil, kerosene, gas, with water. Many miles long to the south, long west.

Up and down the coast every unclipped chimney was set alight to burn the trash. Palm fronds rattled in the fierce winds. And not a cloud in the sky could be seen.

waves clawed at the shores, reaching for beach bathtubs, batels, unoccupied winter homes.

There was a limit to what could be done to save docks, boats, warehouses, barns, and gardens. Most susceptible of all to damage, and least defensible, were field crops and orchard fruits.

Out on fabulous Miami Beach, steel-and-concrete ocean-front hotels were almost invulnerable to hurricanes. And thousands of storm shutters shielded acres of window glass from the cyclone's hurt and puff (page 551).

But losses of decorative plantings, lawns, and beaches, and damage to swimming pools and walkways couldn't be entirely prevented, if the storm center passed that way. Learning from Hitler experience, Greater Miami has put into effect strictly enforced building codes in late years to ensure that every possible safeguard is used in home construction.

At 4 p.m. on August 26, 1945, the hurricane plunged across the Florida coast. The eye passed Delray Beach between 6 and 6:30.

The big wind scalped houses, snapped palm trees, festooned streets with twisted wires, sand-blasted paint from automobiles. Men and women stayed out of sight.

For all the careful preparation, the damage toll mounted up and down Florida: two killed, 133 injured, 265 dwellings destroyed, 24,335 homes damaged, \$45,000,000 damage in that one State, including 17,000,000 boxes of unripe citrus fruit knocked from the trees.

Hurricane Is News Everywhere

A hurricane is always a "natural" as news. It combines in man aliveiture, scientific interest, suspense, and often the drama of heroism.

"When a hurricane smacks the Southeast, it bits front pages pl. across the Nation," Grady Norton pointed out. "And you can bet California papers don't spare the headlines!"

Fortunately, there's a lighter side even to a hurricane.

The day after passage of a recent storm, the *Miami Herald* headed its weather report, "Blew Skies."

Last year's first hurricane worthy of a name headed toward Florida while President Truman was in Miami to address the Veterans of Foreign Wars. Traditionally—or for convenience, hurricanes get alphabetical tags—"A for Able" for the season's first, "B for Baker" for number two; and so on.

In salute to the Chief Executive, newsmen dubbed this storm "Harry." When the season's second hurricane (and one carrying much more authority) slapped the Southland both custom and courtesy could be served. They called it "H for Harry."

In 1947 the battleship *Missouri* was bringing back President Truman from South America. Navy meteorologists didn't know the ship's whereabouts until after issuing a warning on a storm near the Lesser Antilles.

Out of the blue, the *Missouri* sent a message to keep them well posted on the cyclone. Commander Harbord already had been up most of the night, so he railed Grady Norton at the Weather Bureau to make him.

Harbord—"Grady, you'd better get out of that sack and start being sober. Your boat is down on the *Missouri* in civilian clothes. We're not allowed to issue forecasts to civilians, so it's up to you to be sharp on today's weather unless you want to wind up on the farm back home."

Norton—"Well, by golly! How do you think you'll like that weather station in the *Missouri*? If the *Missouri* runs into the storm?"

The Public Visits—by Phone

One day I was in the Miami Weather Bureau office looking over storm records. Across the room, one of the meteorologists was almost continuously busy answering the telephone.

"It's not bad now when there's no hurricane around," Mr. L. G. Purdie observed. "But when a storm's moving in—whew. On one day during the early October hurricane we answered 3,000 calls."

"Mr. Tankers wants to know if he has time to walk his dog before the storm hits. Mrs. Jones asks when Miami stores will open for hurricane sales of damaged goods. One man's question was, 'How soon can I send my wife off to work?'"

I could understand that it must be a relief to the busy Weather Bureau staff when phone wires blow down and cut off the needless, anxious, and often hysterical quertles. Legitimate calls, of course, always are welcomed.

Reassurance, when it's warranted, is what the people want. Lawrence Thompson, a *Miami Herald* writer, did it this way:

There is no new hurricane on the way to Miami. The old hurt one, that passed through here Tuesday, has not turned around and is not coming back toward Miami.

Relax. Go to the show. Just don't call the Weather Bureau at the last minute just because your neighbor heard somebody else's neighbor say somebody else had heard another hurricane was about to come this way.

The Weather Bureau has never in recent years reneged on its matter-of-fact assurance that "No tropical disturbance of serious proportions will ever reach our coasts without being reported well in advance." To this record of success, aircraft reconnaissance by Air Force and Navy, and radar's "magic eye," make vital contributions.

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ORGANIZED FOR THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE

To carry out the purposes for which it was founded twenty-two years ago, the National Geographic Society publishes the *National Geographic Magazine*. As recently as the date of issue of this magazine, the Society had established over 1,000 expeditions, some of which required years of field work to achieve their objectives.

Articles and photographs are desired. For material concerning the following subjects:

In addition to the editorial and photographic interests of the Society, the following subjects are also of interest: Expeditions, some of which require years of field work to achieve their objectives.

The Society's notable expeditions have joined back-to-back since the days of the Northwest Coast in 1848, period of 1879-80, and the return from the Arctic in 1881. By means of the vast communications developed in that region, the Society's records have added records that had passed before and for decades.

In Alaska, the Society and the Smithsonian sent to San Juan Island in 1881, discovered the oldest wood of record in the Americas for which we have a date. This date is now engraved on a tablet in a tree in a date-line timber house built in 1881 at San Juan Island. It antedates by two years anything heretofore dated in America. In 1882, the Society sent to the same place

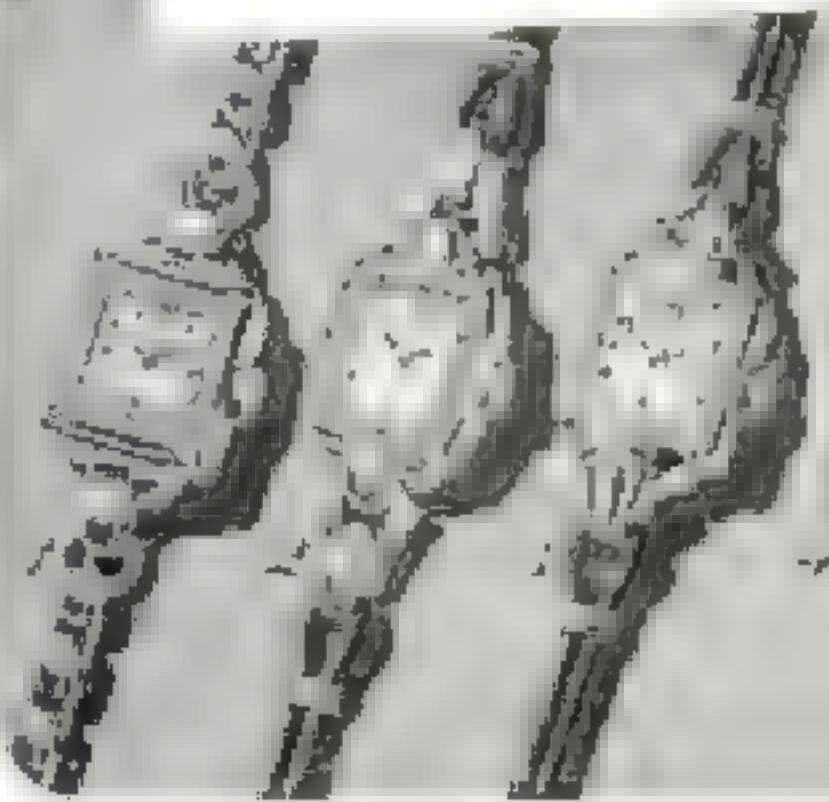
the first expedition to the Arctic, under Dr. Albert W. Stevens and Capt. David A. Balfour. They made the greatest number of scientific observations and published results of extraordinary value.

The National Geographic Society, U. S. Army Air Forces, equipped them a camp in southern Alaska, photographed and observed the solar eclipses of 1917. That was the seventh total solar eclipse of the Society to observe a total eclipse of the sun.

The Society cooperated with Dr. William Beebe in deep-sea explorations off Puerto Rico, during which a world record depth of 4,900 feet was made up.

The Society granted \$2,000,000 in aid that has been given by individuals and organizations to the Society when the amount does not exceed \$10,000. This was conducted, and the first of the giant sequoias from the Giant Forest of Sequoia National Park in California were thereby saved for the American people.

On 10, he sold a large collection and a great many outside the city before was discovered in Alaska and Yukon by Stephen Wrightson while exploring for The Society and the Harvard Institute of Exploration, 1936.



શ્રીમતી અભિન્દા પટેલ જન્મના તેવાં હોય કે તેવાં
જીવનના એવાં હોય કે જીવનના એવાં
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એવાં હોય કે જીવનના એવાં હોય કે જીવનના



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your news to you at the
price. Now there is another
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cheaper way, and that is to read
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The first step is to identify the
TEN most highly correlated
variables and then to use it
as a starting point for a set
of successive steps that will
allow the analyst to identify
the variables that are most
important.

W. H. G. - 1900

It seems like it's been a
long time since I last wrote.
I've been working on my
new book, *The Great
Game*, and writing
articles for *Forbes* and
other publications. I also
do radio, television, and
internet interviews. The
new website is up and running
and I'm getting lots of traffic.

the first time in the history of the world, the people of the United States have been called upon to decide whether they will submit to the law of force, and let a single man, or a small party, control their destiny.



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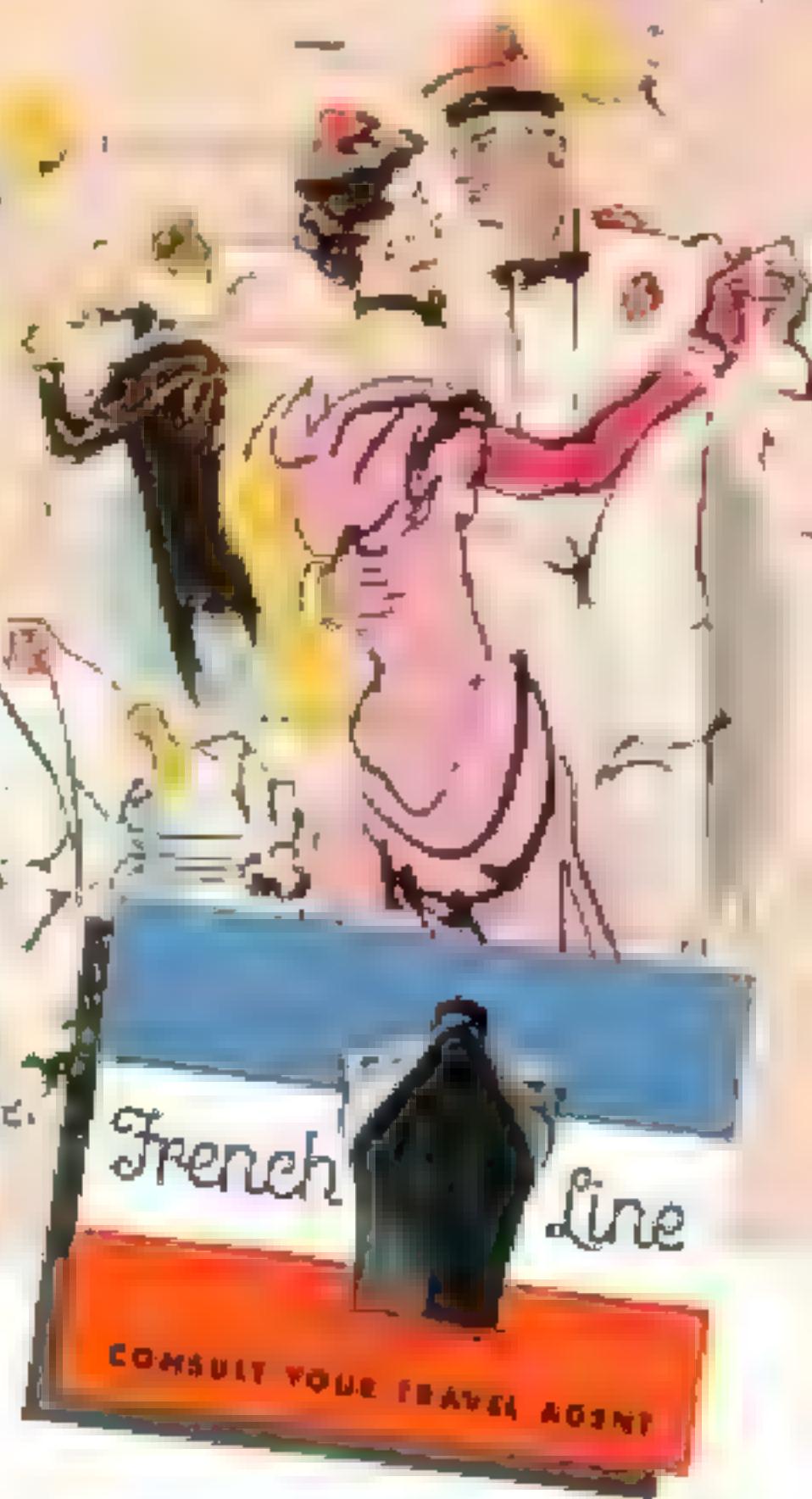
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Until you've tried it, it's hard to believe what a convenience this great new General Electric Automatic Dishwasher can be.

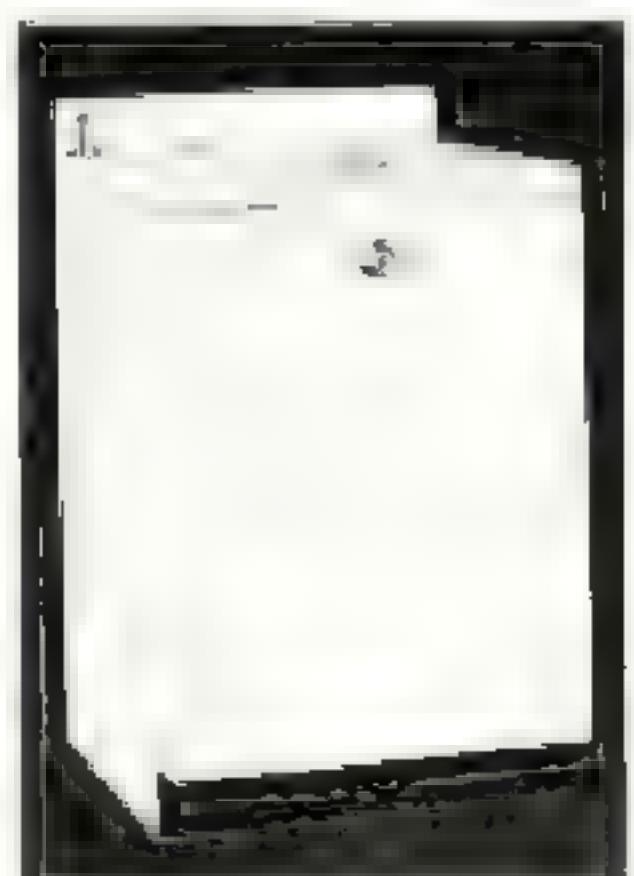
We know you'll like it too—because it's better than any other dishwasher. It saves you over 200 hours of hand washing work every year. And it costs under \$200.00. Import it over from Europe.

It's so easy to use. The controls are simple, the power cord is safe with a ground connection. And it's built with a quiet, trouble-free GE motor. You can't go wrong!

It's a lot more than just a new dishwasher. It's a new way of life. You'll never have to scrub by hand again. And with the help of your GE Automatic Dishwasher, you can do more in less time.

COMBINATION MODEL *

The new G-E combination model has all the benefits of the new dishwasher, plus the convenience of a built-in electric clothes dryer. Both units are completely controlled by one simple control.



FREE-STANDING MODEL

The same efficient, modern dishwasher features of the built-in model are also available.



The new G-E dishwasher has all these features:

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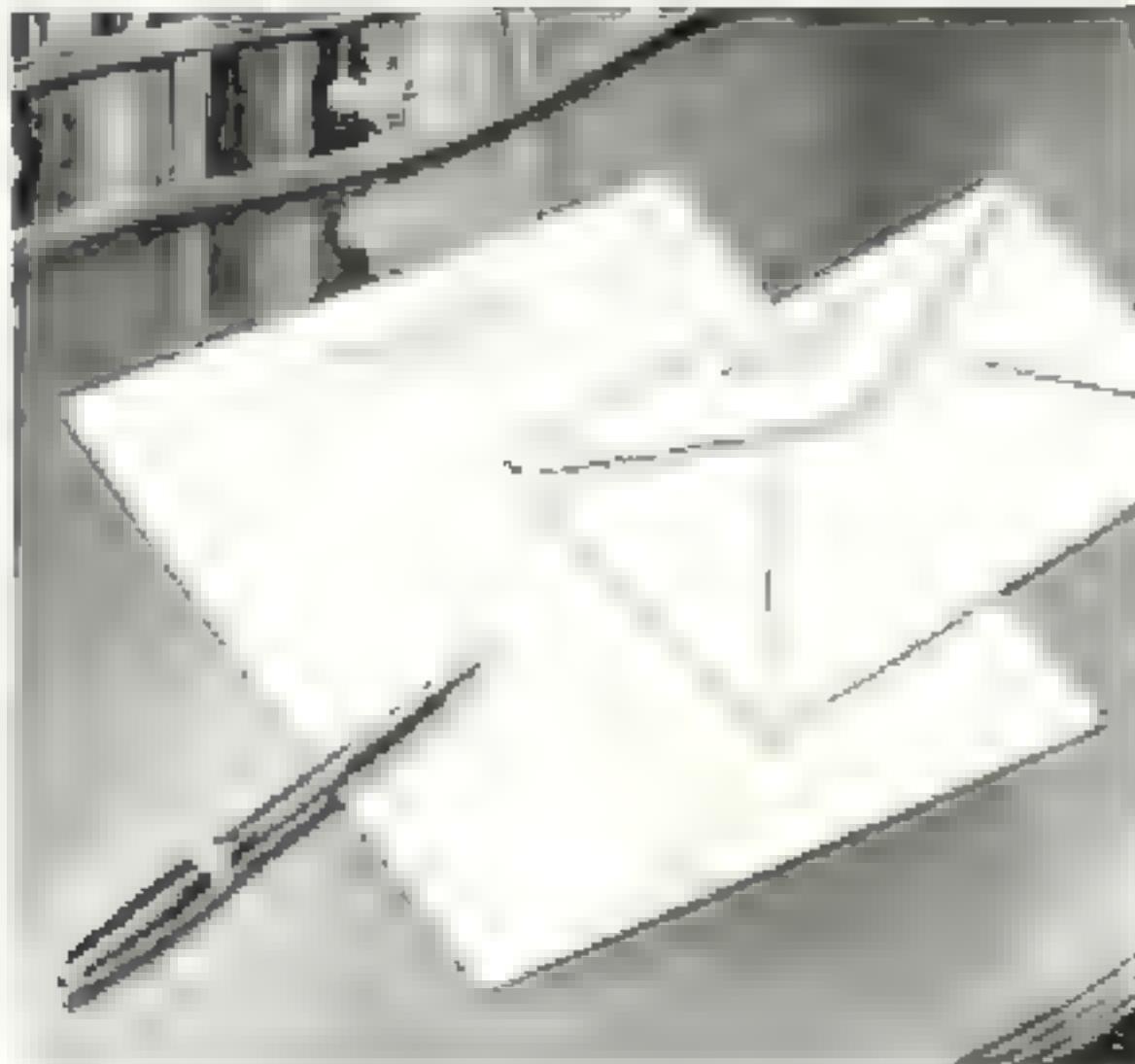
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These are some of the many masterpieces created by William Wallace. His unique ability to combine beauty, craftsmanship, and function has made him one of the leading trophy manufacturers in the world. His trophies are sold in over 50 countries and are highly regarded for their quality and craftsmanship. They are available in a wide variety of designs, including traditional and modern styles, and are suitable for both indoor and outdoor use. Wallace trophies are made from the finest materials and are designed to last a lifetime. They are perfect for awarding achievement in sports, academics, and other fields. Whether you are looking for a trophy for your child's school or a trophy for your favorite sport, Wallace has something to offer. To learn more about Wallace trophies, visit our website at www.wallace-silver.com.

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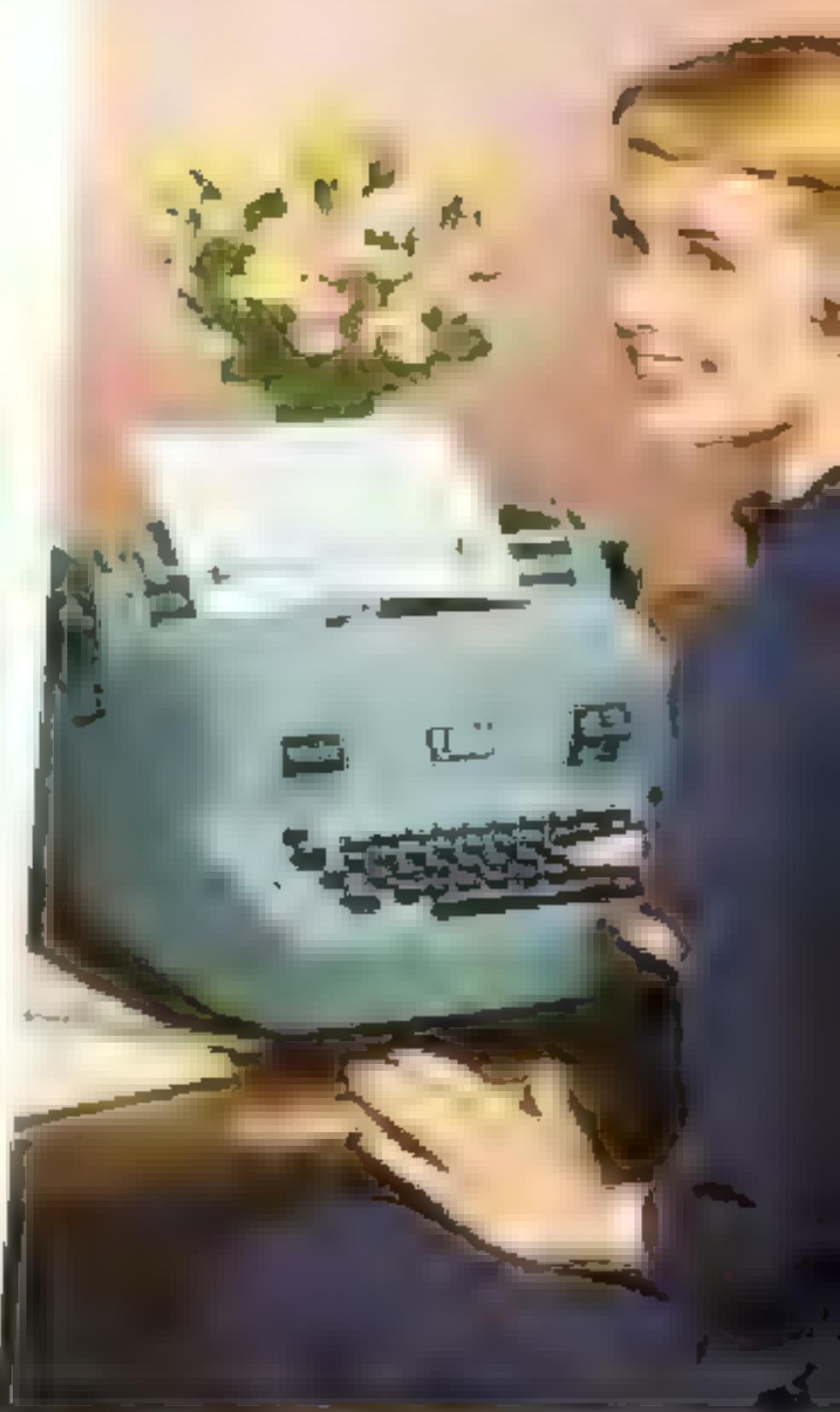
Dear Sir:

The letters I send you impress me.
They are like handwritten impressions.

With the IBM Electric Typewriter, you can make
handwritten impressions. It has a clear, distinct, clean,
natural look that adds to all typewritten work.

Electric Typewriters are built to last.
Standard. It's built to last. It's built to impress.
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wide choice of colors and type faces.

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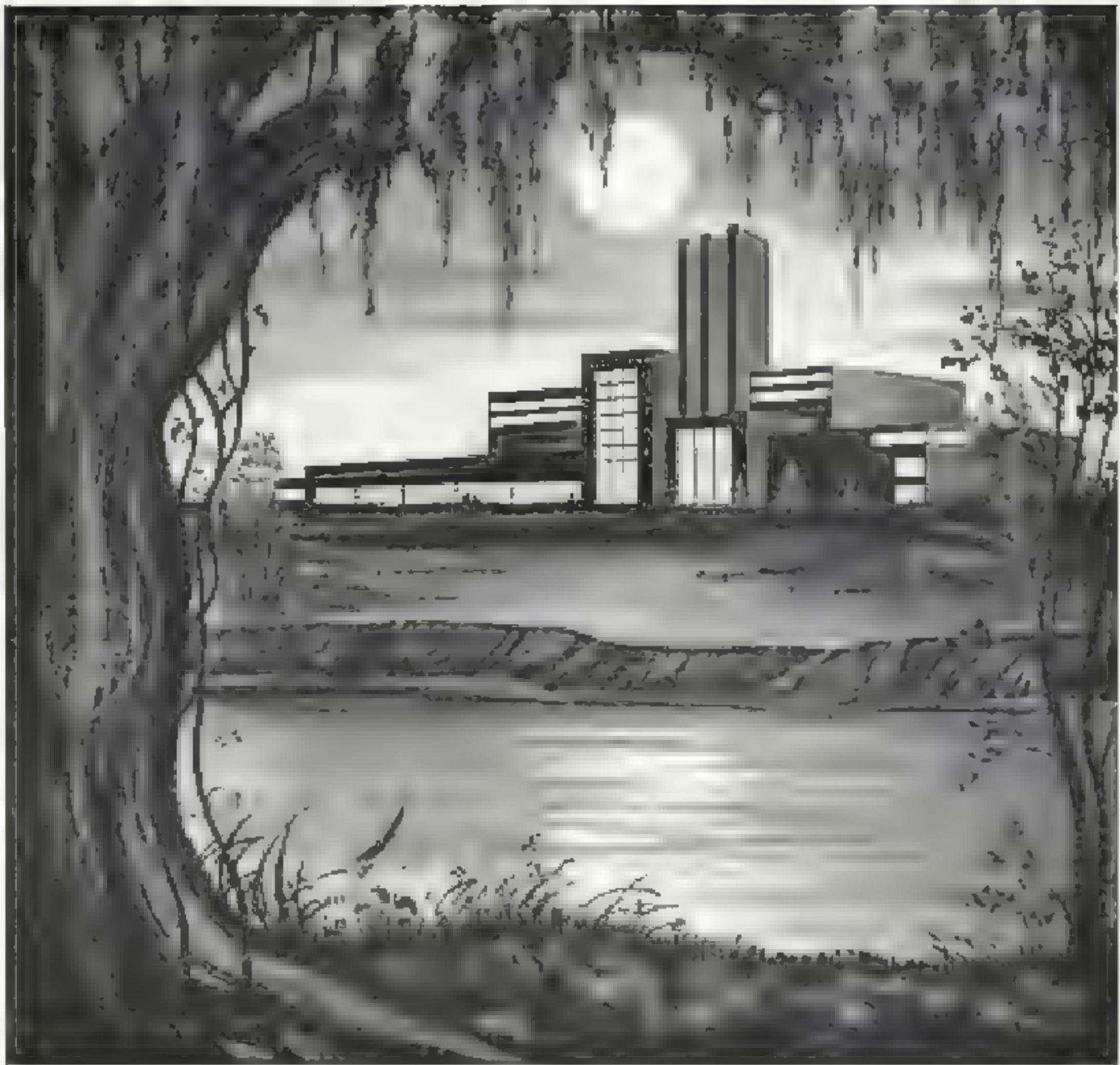
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There is great happiness in television...great happiness in the home where the family is held together by this new common bond—television.

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television's finest instruments...the Du Mont receivers.

Everything a television set can be, everything it can offer—a room-

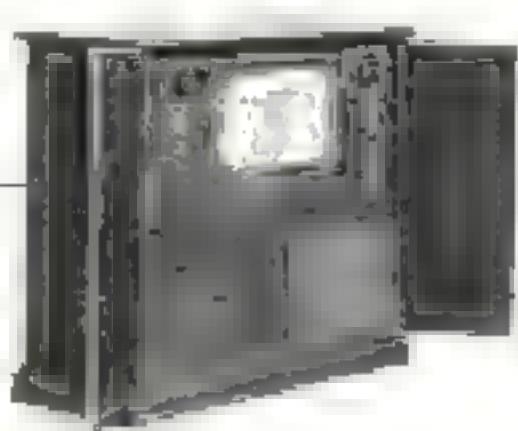
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Du Mont built the first commercial home television receiver—

Du Mont builds the finest

DU MONT

First with the finest in Television



The Television by Du Mont, with
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They're downright comfortable!"

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Ride great
trains through
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Every autumn is a hunting season in Pennsylvania. As the foliage turns gold and orange, new pastures are born. The barns are filled to bursting with grain, and the woods are filled with game.

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The Club is where you go to
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The Club promises a three-fold
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ALL RECORDED MUSIC



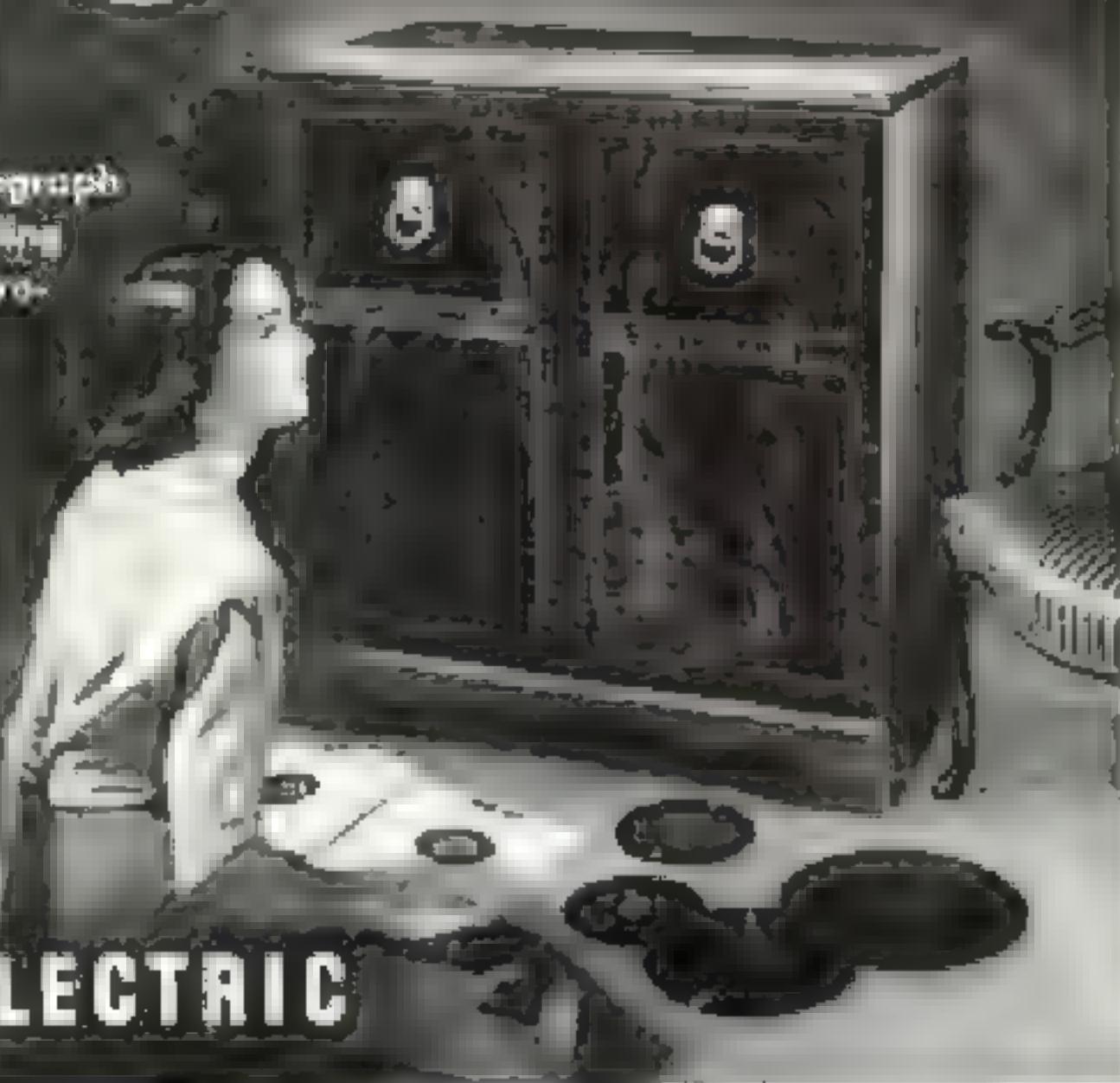
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This luxurious new G-E radio-phonograph was designed for the most discriminating music lovers. Its G-E Electronic Reproducer lends magic quality to all records, discs, tapes, cassettes, AM radio and genuine Armstrong FM. Finely figured full-length doors. Genuine hand-rubbed mahogany veneered cabinet; top and sides. Model 735.

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The chlorine-oxygen mixture does the cutting or welding of metals that go into buildings, houses, and ships.

But that is only one of the many combinations of the remarkably "friendly" molecule. This gas has a wonderful eagerness to combine with other materials... and such unions can create an amazing variety of chemicals and other products.

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Hydrogen	4000° F.
Hydrogen Chloride	3000° F.
Hydrogen Fluoride	2000° F.
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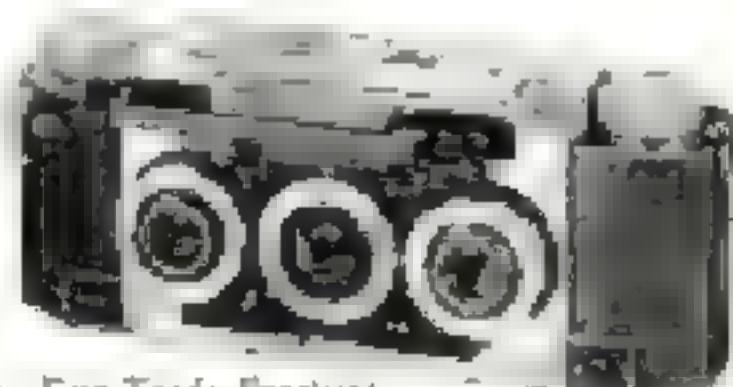
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STEREO Realist

THE JOURNAL OF CLIMATE VOL. 21, NO. 15

Wanting the National Geographic is something you

Record-Playing Confusion - a Nuisance of the Past!

New Zenith Cobra-Matic

Plays any speed record now made or yet to come - 10 R.P.M. to 65... and... any size record - 7, 10 or 12 inch - with two simple controls a child can operate.



Here at last is the record player you so wisely waited for! With the first and only change of this automatically played all records of any speed now made or yet to come - from 10 to 65 R.P.M. - 7, 10 or 12 inch.

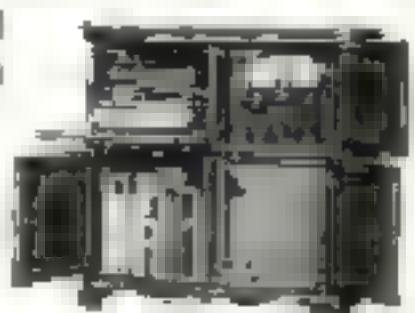
It's all done with two simple controls which can operate fast, full or in intermediate speeds - 10 to 35, 35 to 50, 50 to 65, plus speeds from 10 to 80 R.P.M. per minute! And the other control for record sizes 7, 10 or 12 inches is so simple - you'll hardly ever touch it. Our Super-Cobra Tone Arm, with a built-in repeat button, is so well balanced and neatly styled that you'll want to show off your Cobra-Matic. What? No needles, just spindles or what you like, or what?

In addition to enjoy the best in static-free radio reception with Zenith's Super Sensitive 1M, you get the famous Tone Control at AM. More power than ever before by a new speaker 2½ times more sensitive than any Zenith has used before.

How about you make in a local storehouse from record and radio? You can't be quite as confident that you have the best until you hear its performance and execution quality. See your Zenith dealer and you'll hear for yourself.



Above: New Zenith "Tydor" Console Radio-Phonograph. Cobra-Matic™ turntable turns both FM, Long Distance AM and regular Tone Control. Power output: 1000 watts. Magnifying horn shown.



\$199.50



New Zenith "Headphone" TV Combination. It features inch 2 x 1 television, Color Music Changer, FM AM Radio, Turntable, Phonograph and Full Color TV.

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AND TELEVISION





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88th ISSUE

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AMERICAN EXPRESS TRAVELERS CHEQUES

F. O. SCHWARZ 145 FIFTH AVE., NEW YORK 22 N.Y.

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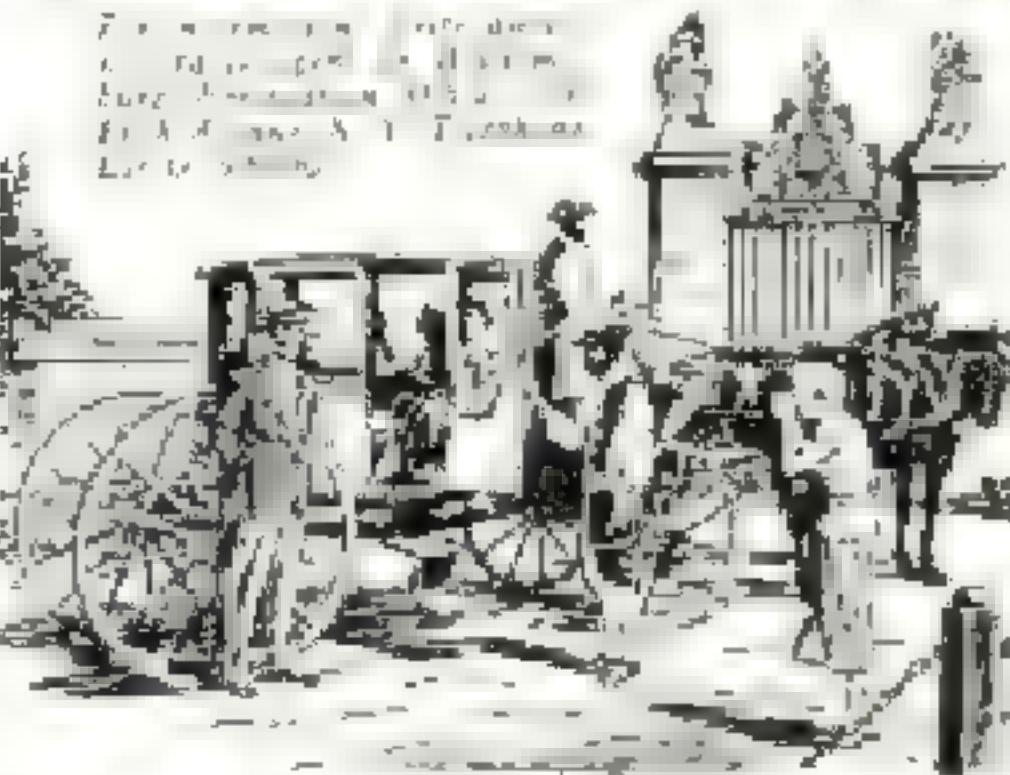
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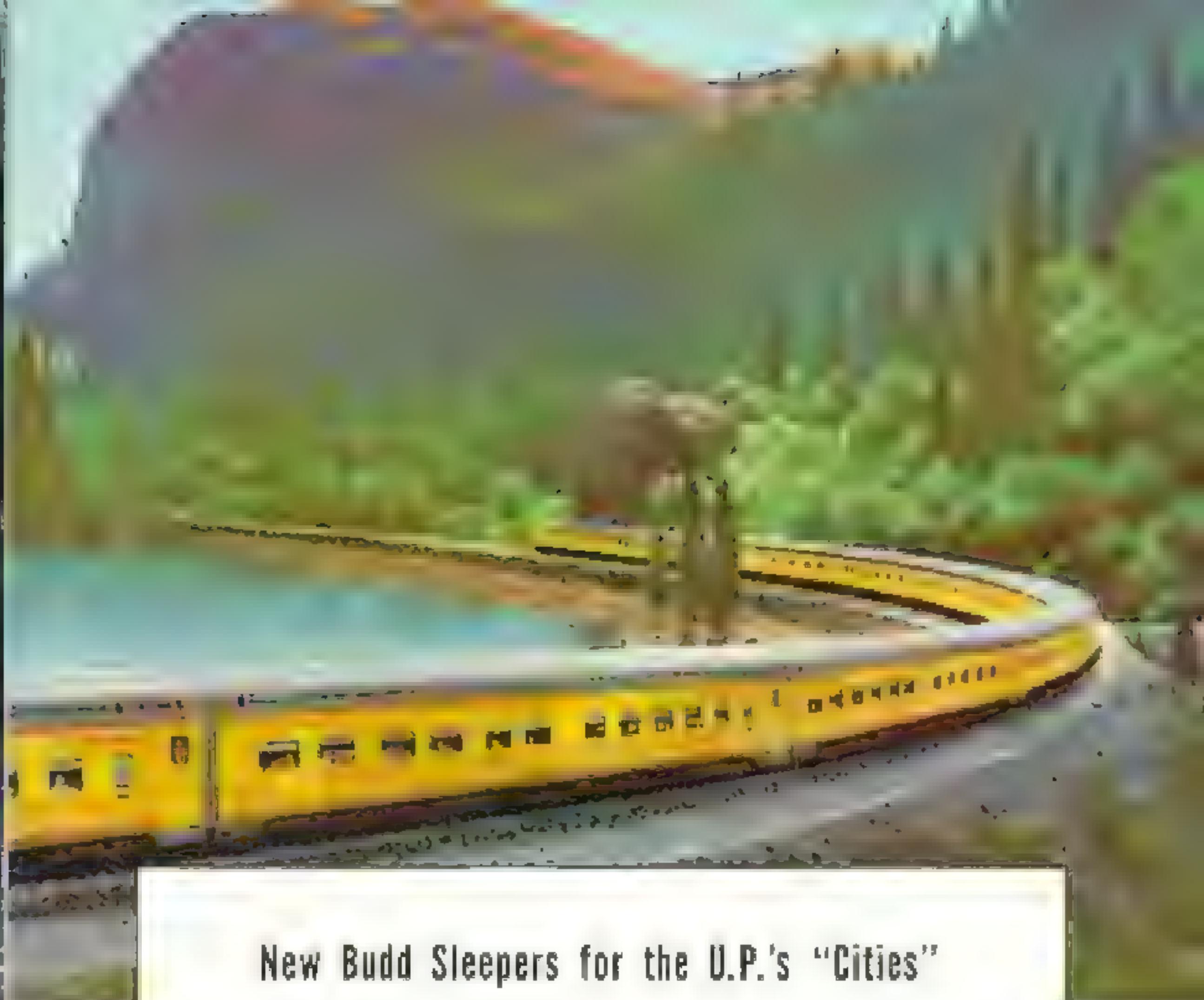
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Welcome to historic Williamsburg

Plan now to visit restored Williamsburg—where Washington, Jefferson and Patrick Henry championed our Freedom. You'll enjoy the pleasure of a ride in the buggies and carriages—trips to Jamestown, Yorktown and nearby plantations. Also golf tennis, cycling. Fine lodgings at member hotels, comfortable guest houses and restored inns.

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New Budd Sleepers for the U.P.'s "Cities"

Brief hours of sheer luxury await you aboard the new Budd stainless steel cars recently delivered to the Union Pacific. They have joined the consist of those famous streamliners—City of Los Angeles, City of San Francisco, City of Portland—to whisk you gently, memorably over the nation's transcontinental railroad.

If you have never traveled in a modern, all-room Pullman as Budd designs and builds it, look forward to a new experience in comfort and enjoyment when you board these beautiful trains. Restful quiet. Relaxing stability. Budd disc brakes that stop your train—with a leather-touch. Beauty and convenience in every appointment to your room. Enclosed clothing wear

robes in every room, and enclosed toilet facilities in double bedrooms.

And with all this you enjoy the security that comes with their stainless steel car bodies. Stronger than iron, stainless steel, three times as strong as ordinary steel beneath the soft carpet on which you walk... behind the pleasing color scheme,atching the roof above you. By no means the least of the pleasures of travel is the knowledge you ride in safety. And no one provides it in such degree as Budd. The Budd Company, Philadelphia, Detroit, Conn.

Budd

25% to 50% more food space

No food wasted in the home that has a dependable
General Electric Space Maker Refrigerator!

G-E Refrigerators give you much more storage space than most refrigerators now in use... yet they occupy no larger floor area!

Remember that the new General Electric Space Maker Refrigerator gives you more storage space in less floor area.

1. SPACE The G-E Space Maker refrigerator occupies less floor area than most other refrigerators now in use. Now, no longer do you have to wait until you have enough floor space to get a refrigerator.

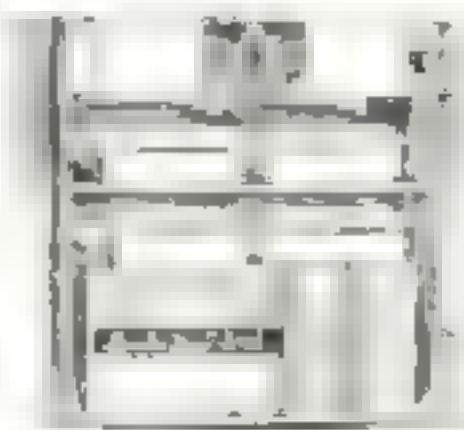
2. CONVENiences General Electric Space Makers have more conveniences than ever before. There's more room for more things.

3. DEPENDABILITY, the dependability of G-E Refrigerators make them the most reliable refrigerators after 10 years. They're built to last.

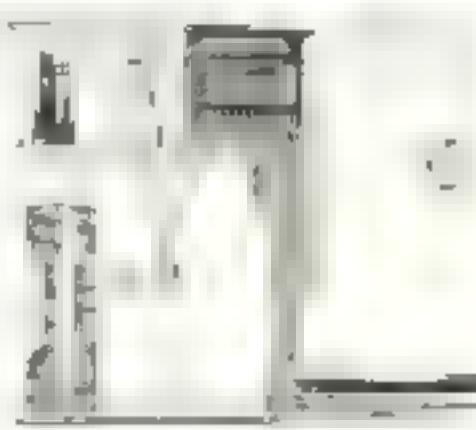
See your General Electric Dealer. You'll find him right in your local telephone directory under "Refrigerators." General Electric Refrigerators. Dependable. Dependable.



Model M-100—\$1,150.00



Stores 24 pounds of frozen meat. New combination door and drawer system eliminates waste and makes it easier to store frozen foods. There's more room for more things.



Holds 12 square feet of meat. New combination door and drawer system eliminates waste and makes it easier to store frozen foods. There's more room for more things.



Large foods are no problem. Large drawers hold more meat. Large doors hold more vegetables. Large shelves hold more fruits. Large compartments hold more bread.



Wide, deep冷冻抽屉可以存储更多的肉类。抽屉和门的组合使得储存肉类更加方便，同时节省空间。有更多的空间储存更多的东西。

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Miami Beach

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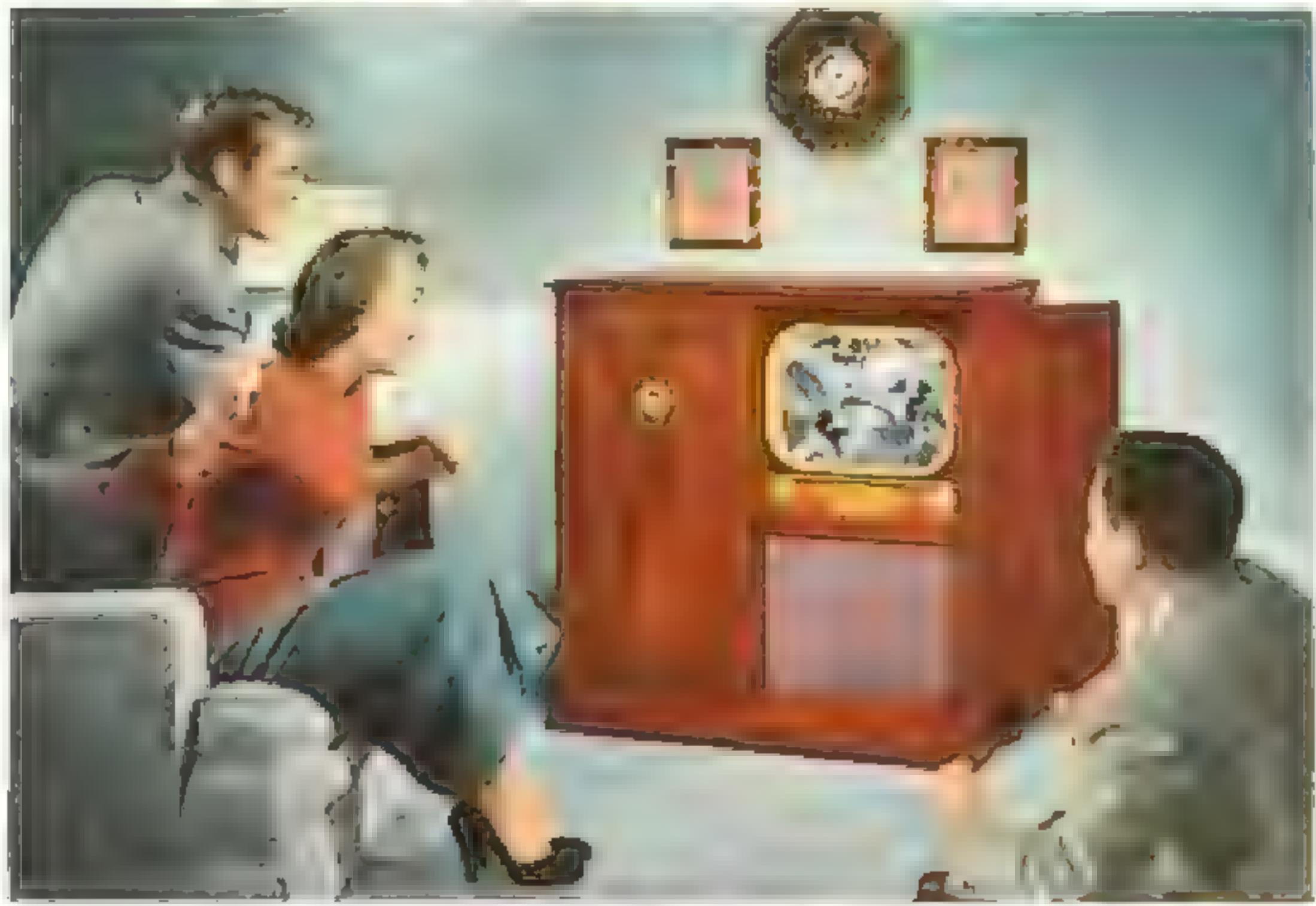
- pros:
 - a superb voyage aboard
 - a modern luxury liner—an unforgettable vacation in itself!

Seit dem ersten Urkunftsbericht und damit der Entstehung des Geschichtsbegriffs ist die Geschichtsschreibung von Menschen geprägt. Ein wichtiger Grund dafür ist, dass die Menschen nicht nur über die eigene Erfahrung verfügen, sondern auch über die Erfahrung anderer. Diese Erfahrung wird durch Geschichtsschreiber überliefert und weitergegeben.

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coastal waters of the Americas,
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New York

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Every monument bearing the Rock of Ages seal is backed by a bumper you cannot top it. Your seats are reserved—anti.

Many thoughtful people choose their family monument — as well as their cemetery lot — before the need arises. Ask your dealer or write Rock of Ages, Barre, Vermont, for "How To Choose a Family Monument" — a large illustrated book available without charge or obligation.

ROCK *of* AGES

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New weapons help fight ARTHRITIS

Much as science advances, our methods and means for combating experts' well-known new disease become greater. But in many cases, even though the disease has not been cured, the condition can be controlled. This is certainly true with very many arthritis patients, and the only



for research purposes, and the limited use is important in certain treatments.

I saw with great interest some letters to a newspaper recently from arthritis sufferers who wanted to know if there was any diet which would help relieve their affliction. One of the best answers to this question is the prompt and continuing loss of weight, especially in the obese.



This often comes with arthritic patients called "sunburns" which may temporarily relieve pain but generally do more damage than good in the final results of the disease. According to the Arthritis and Rheumatism Foundation, one of the most effective ways of helping to control the disease is through

loss of weight and in some cases through diet.

The most common disease of the joints is the so-called "rheumatoid arthritis," which usually begins before age 40 and increases with age, being found in about 10% of people past middle age. Once diagnosed, treatment includes a complete physical examination, the doctor can usually determine what type of arthritis is present and prescribe a treatment which will affect the particular disease.

Among other things, the doctor may recommend beginning the weight-loss program



Even a loss of just 10 pounds of extra weight can considerably reduce the load on arthritic joints, especially on the weight-bearing joint. However, it is important following a diet to eat a balanced, low-calorie diet, maintaining proper protein and proportionate attention to body building.

With the aid of a physician and a dietitian, the diet can be carefully planned to fit the needs of the individual patient. However, it must always be remembered that a diet is not a cure. Today, you can hope that one of the real weapons for the millions of people with this condition

Metropolitan Life
Insurance Company
A MUTUAL COMPANY
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Name _____	<input type="checkbox"/>
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This idea put them across the Platte

TEARS of the covered wagon trains heading West in the 1800's headed the finding of the Platte.

The river acquired its ominous reputation because even experienced scouts could never tell where the pockets of quicksand and the patches of ice—so changeable was the strong current of the broad and muddy stream.

When an ox team bogged down, straining a waggon, the prairie schooner was usually overtired, dumping family and possessions into the river.

The most well-learned Front scouts, who had crossed the river before, knew how to tackle the Platte.

When a number of wagons had arrived at the river, the oxen from all of them were hitched together to pull each of the families across. Even though one team in the long string annihilated, enough were on hand, pulling to keep the wagons on the move.

Maybe you've never thought of it, but every family today—just as the settlers crossing the Platte—is faced by dangers it cannot cope with alone.

A fire or whirlwind may damage the home. An accident or death may stop the salary. The family lives on—and costs its living in hospital and doctor bills.

In facing such dangers as these, no man need stand alone. Through insurance, you combine your resources with others who face the same kind of danger (as the pioneers did their way) to meet and make safe an uncertain future.

Next time you see Traveler's agent or broker drop in, drop a line and talk with him about the kinds and amounts of insurance you need!

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HORMEL HAM



Ham's the ticket!

You can slice it cold right from the can. Or, if you can bear to wait, heat it at 350° long enough to heat through. You can eat every bit because it has no bone, no skin—with just the right amount of fat left on. Hormel pre-cooks it in the can to save every subtle wisp of flavor—all big tender pieces of delicious ham...ham at its very best.

WHOLE . . .

[Illustrated] 6½ pounds of cold meat—light rimmed with fat. A ham-and-dance.



QUARTER . . .

1½ pounds of the same good ham—boneless, skinless. Convenient family size.

128



Other good ways to buy
HORMEL HAM

CHOPPED . . .

Canned sliced chunks of Hormel Ham—12 oz. or can size, for all uses.

DEVILED . . .

Hormel Ham chopped fine with onions, seasoning, King of condiments spread.

WITH BEANS . . .

Big juicy chunks of Hormel Ham cooked with beans in a rich sauce—wuchs or supper for 2 or 3.



HORMEL
HAM

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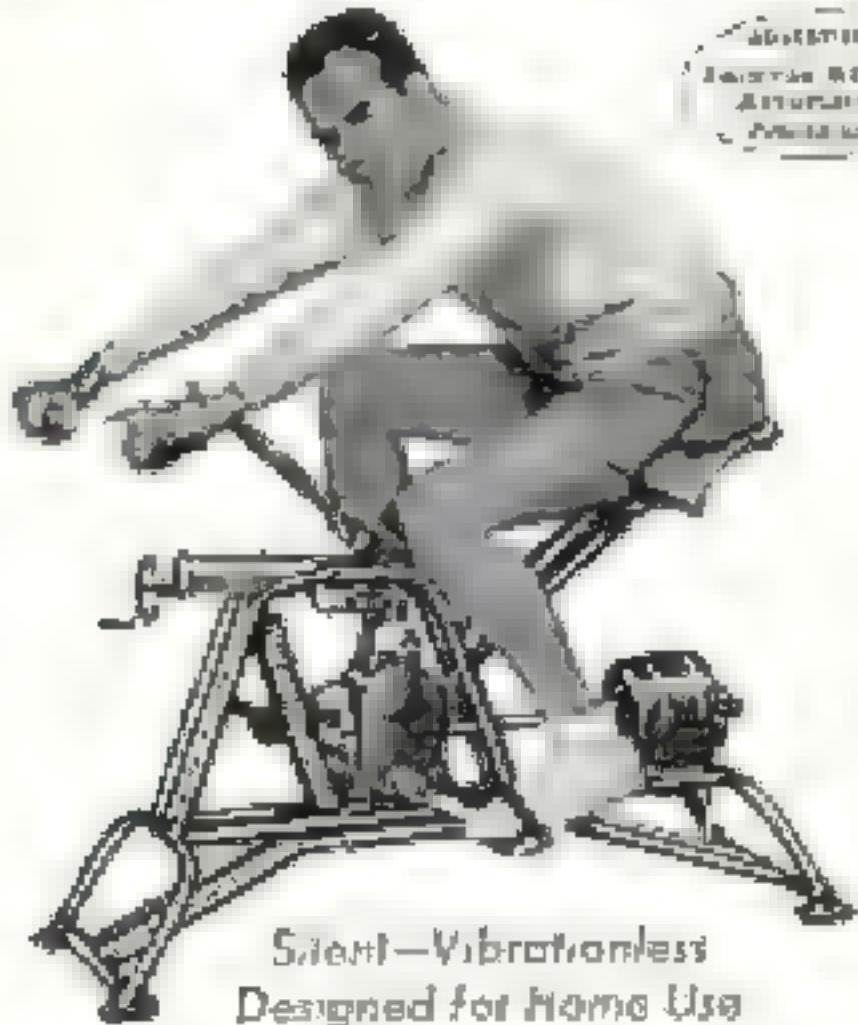
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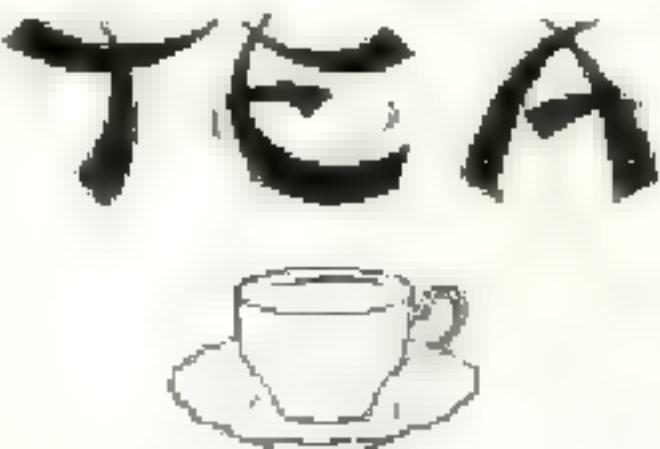
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Proposed by the company owner to attract the attention of the customers.

Legend — You can see the fluffy, brownish leaves of the *Ulmus* (elm) in the background.

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the commandant Adm. and he's
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Count your savings! New E.P. Auto
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- The author left the camp after a short time with the other members of the group. He left, however, to
 - The author left the camp after a short time with the other members of the group. He left, however, to
 - The author left the camp after a short time with the other members of the group. He left, however, to

1. The following is a list of the names of
the members of the Board of Directors
of the Company, and the date of their
appointment:

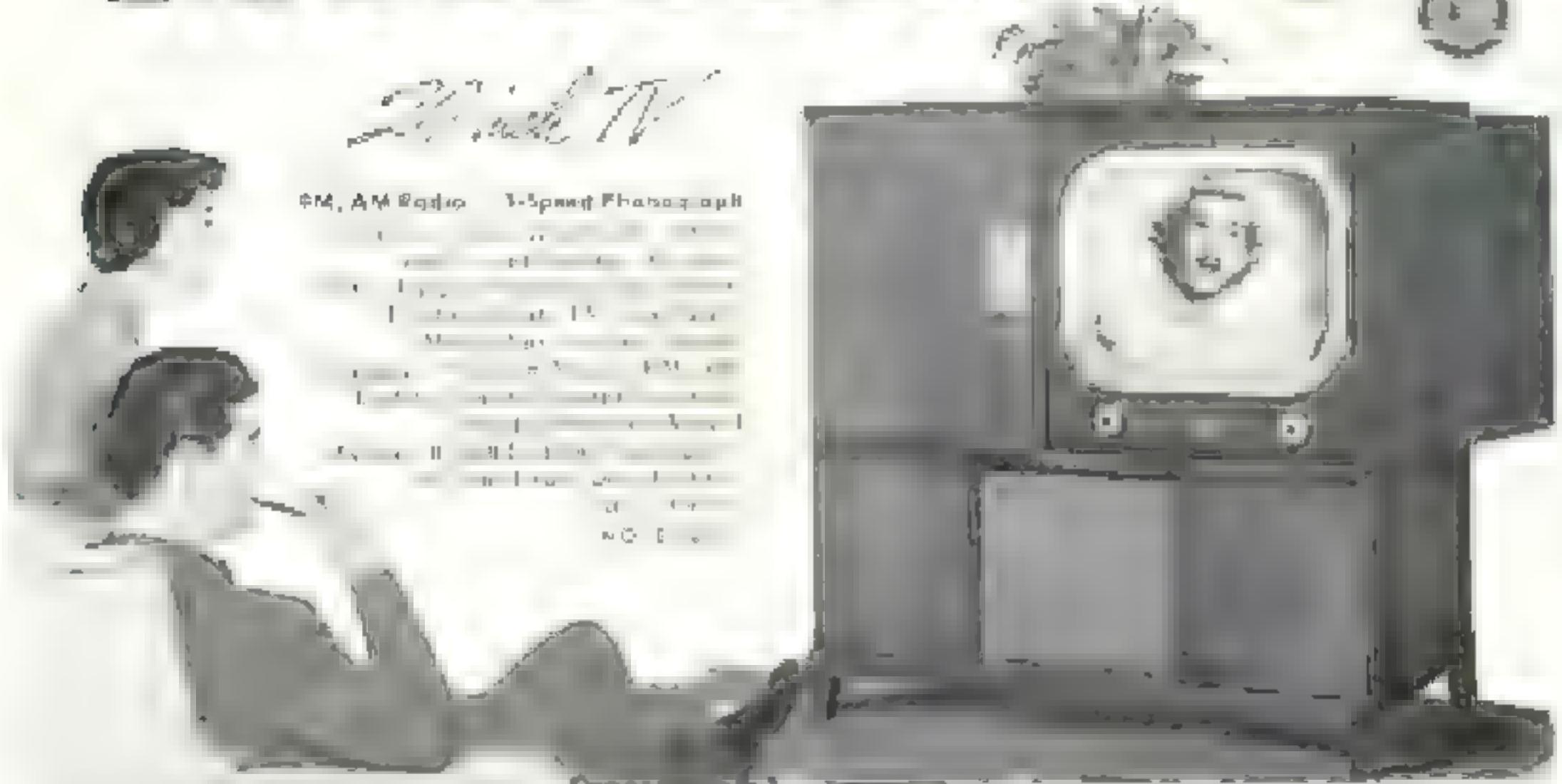
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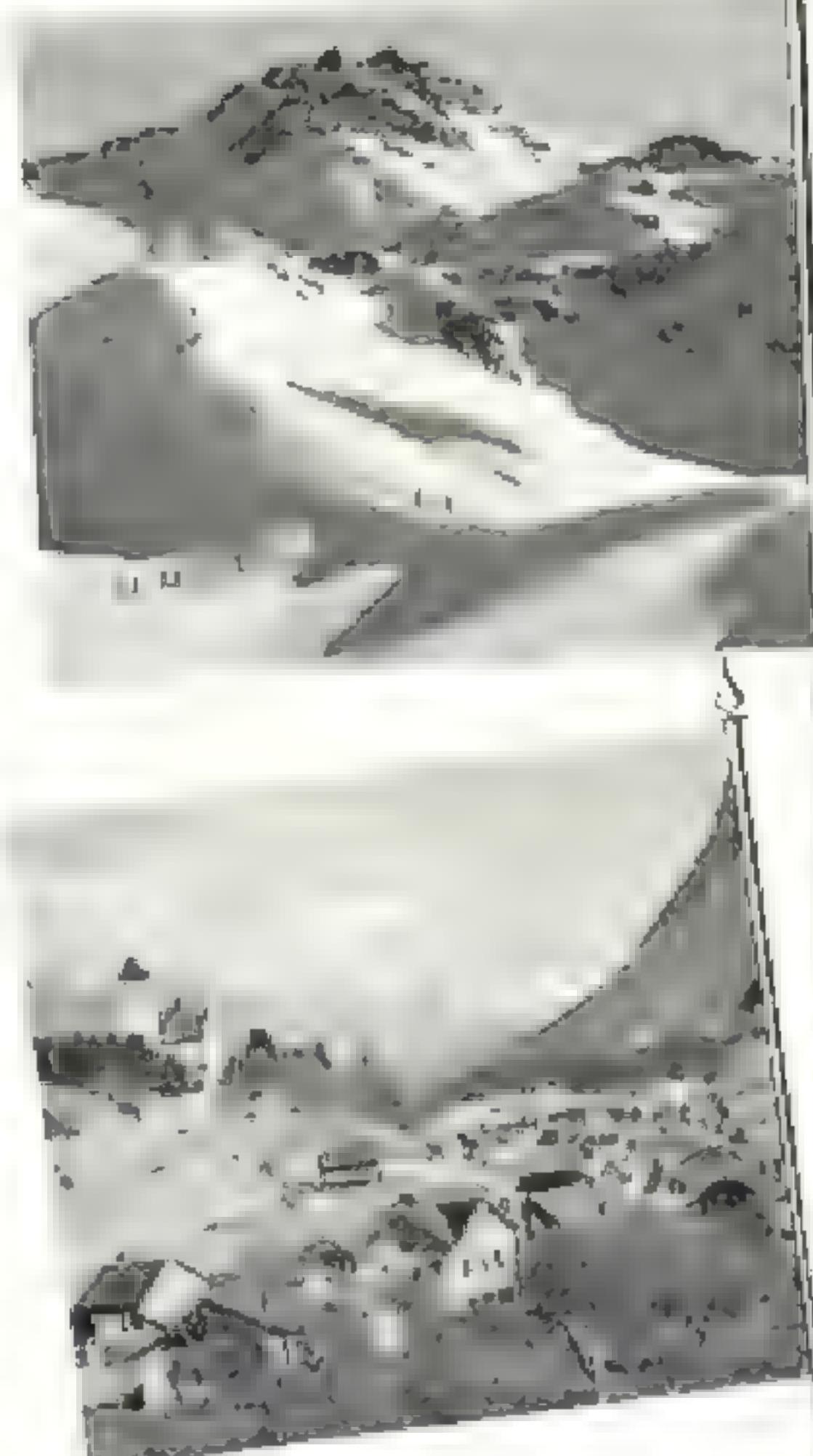
BERNDT-BACH, Inc. Manufacturers of motion picture cameras and accessories

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— 16mm SOUND-ON-FILM SINCE 1891 —

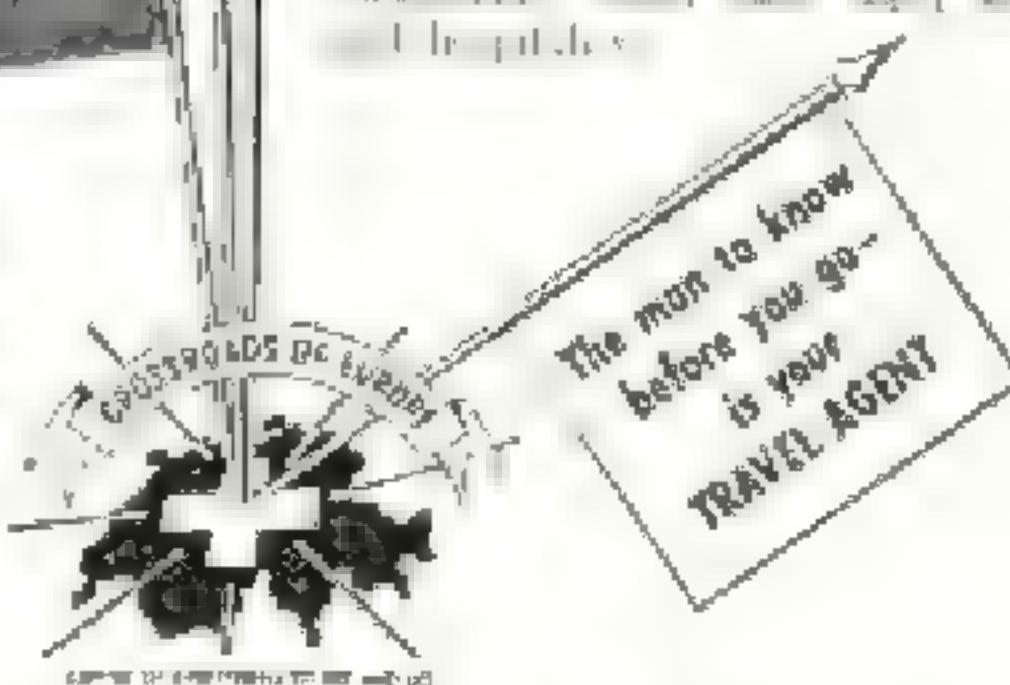
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Because I am going to start teaching students how to
analyze the text, I will have them do some
close reading of the text to determine what
the author's purpose is. I will also have them
analyze the text to determine what the main
idea of the text is.

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steps will keep your home looking like new.
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And I know who I'm gonna see
In September when the leaves turn
yellow with golden light and
the birds begin to sing.
I'll find a place where I can sit
in the sun all day long,
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1950

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The WATCHMAKERS OF SWITZERLAND



All the 150-odd parts of a fine Swiss watch are finished and assembled to perfection, making it possible for your jeweler to service any make of fine Swiss watch both economically and promptly.